National Aeronautics and Space Administration

August 2, 1999
AO-99-OES-02

University Earth System Science (UnESS) Project Announcement of Opportunity

Office of Earth Science

Notice of Intent to Propose Due **October 20, 1999**
Proposal Due: **December 1, 1999**

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University Earth System Science Project
Announcement of Opportunity

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University Earth System Science Project
Announcement of Opportunity

1.0 Description of Opportunity

1.1 Background and Provisions

The National Aeronautics and Space Administration (NASA) Office of Earth Science announces the opportunity to conduct innovative space-borne Earth system investigations in the form of complete spaceflight missions or secondary payload instruments through the University Earth System Science (UnESS) Project. This Announcement of Opportunity (AO) is intended to foster the development of the next generation of Earth system scientists, engineers, managers, educators, and entrepreneurs through significant and meaningful hands-on student involvement in Earth observation space missions at the university level. The hands-on student involvement should include helping prepare the proposal through analysis and distribution of the data to the scientific community. This AO will give equal weight to the scientific/applications and student involvement aspects of the proposal. The scientific merit of the mission can be intrinsic to the mission itself, or based on the impact of the technology demonstrated through the mission. For the purposes of this announcement, the term "Earth system science/applications" encompasses all of the Earth Science Enterprise's goals.

The Office of Earth Science is the NASA headquarters office that manages the Earth Science Enterprise. The Earth Science Enterprise is one of four NASA strategic enterprises; implemented NASA-wide through the NASA Centers and through academic and industry partners.

1.1.1 Earth Science Enterprise Goals

The goals of the Earth Science Enterprise are to use the global perspective of observations from space to develop an understanding of the total Earth system and the effects of natural and human-induced changes on the global environment.

The program of the Enterprise will be guided by the following scientific themes:

- Biology and Biogeochemistry of Ecosystems and the Global Carbon Cycle
- The Global Water and Energy Cycle
- Climate Variability and Prediction
- Atmospheric Chemistry
- Solid Earth Science

In addition, the Enterprises fosters applications research and commercial developments aimed at more pragmatic issues including:

- Food and Fiber
- Natural Resources
- Disaster Management
- Environmental Quality
- Urban and Infrastructure
- Human Health and Safety

Additional information concerning these themes is provided in Section 2.1, Appendix A, and through appropriate links found on the Office of Earth Science homepage at Internet address http://www.earth.nasa.gov.

1.1.2 Commercial Endeavors Provision

Both National and NASA policy require NASA to support private-sector investment in commercial space activities by committing the U.S. government to purchase commercially available goods and services. In addition, NASA's policy is to work cooperatively with other U.S. government agencies and our International partners in the development of a comprehensive capability to observe and understand the Earth. NASA will purchase commercial data whenever the commercial data are cost effective and meet NASA's requirements, rather than develop a mission that produces comparable data. If at the time of proposal evaluation there is a likely or approved measurement capability similar to that proposed, these policies will preclude selection of that proposal. NASA will select a mission only if the proposer can demonstrate that the proposed mission can deliver science data that does not compete with or duplicate other capabilities.

1.1.3 General Provisions for this Announcement of Opportunity

Proposals submitted in response to this AO must be for complete end-to-end investigations encompassing all mission phases, including flight hardware development. Proposals must provide for significant and meaningful "HANDS-ON" student involvement across a variety of university schools (e.g., Engineering, Science, Business, Journalism and Communications, Graphic and Fine Art, Education, Law, etc.). In addition, the participation of Historically Black Colleges and Universities (HBCU) and Other Minority Universities (OMU) including Hispanic serving institutions or Tribal colleges and universities are strongly encouraged. The list of U.S. accredited post secondary minority institutions can be found at the Internet address http://www.ed.gov/offices/OCR/99minin.html.

For purposes of this AO, mission phases (See NASA Document NPG 7120.5A) are defined as follows:

Phase 1: Mission Concept Studies
Phase 2: Mission Definition and Preliminary Design
Phase 3: Mission Detailed Design
Phase 4: Mission Development and Launch
Phase 5: Mission Operations and Data Analysis, Archival, and Dissemination

UnESS investigations can be complete flight missions using free-flyers on expendable launch vehicles or the Space Shuttle, or the investigation can be a partial mission on another spacecraft, International Space Station (ISS) or Space Shuttle cargo bay launched by the Space Shuttle or another launch vehicle. The ISS opportunities include external attached payloads intended for the EXPRESS (EXpedite the PRocessing of Experiments for the Space Station) Pallet and internal, pressurized payloads intended for the Window Observational Research Facility (WORF). Both opportunities are described in the ISS UnESS Research Opportunities document found in the UnESS Project Library. No balloons, aircraft, or sounding rocket mission will be considered, although these may be included in support of the space flight mission, for example for calibration/validation measurements. Investigations are capped at $15M in NASA Earth Science Enterprise funding. Lower cost investigations are encouraged, and those investigations proposed at or near the cap will not be able to adjust to above the cap during the Concept Study.

1.2 Proposal Evaluation, Selection, and Downselect Process

Proposals will be assessed against the criteria given in Section 5.2 by panels of individuals who are peers of the proposers in the relevant scientific/applications, technical, management, cost and educational areas. The UnESS Evaluation Executive Committee will review the results of the proposal evaluations, conduct an independent assessment of the evaluations, and categorize the proposals in accordance with the NASA Federal Acquisition Regulation (FAR) Supplement (NFS) Part 1872.0 (See Section 5.1). After this review, the Committee will present the final categorization results, the results of other reviews and evaluations, the total proposed costs, and comments and recommendations from the Office of Earth Science Division Directors to the Selection Official, the Office of Earth Science Associate Administrator. The UnESS Selection Official will nominally select six proposals for nine-month concept studies. Once these studies are complete, each team must submit a Concept Study Report. NASA will conduct a Downselect Process using the same general evaluation criteria listed in Section 5.2 to select the nominally two investigations that will continue into definition, development, flight, mission operations and data analysis and distribution. Section 5.0 provides additional details on these activities.

1.3 Proposal Opportunity Period and Schedule

NASA is seeking UnESS investigations through this AO with mission launch dates in 2003 and/or 2004. Investigations that can be ready for launch earlier will be considered, although hardware funding under this AO will not be available until after the downselection. Investigations with anticipated launch dates later than this should be proposed in response to subsequent UnESS announcements that are planned to be released every two years. If your instrumentation requires additional development to prepare for future solicitations, we encourage you to consider proposing to NASA technology development programs such as the Instrument Incubator Program (IIP).

The following schedule describes the major milestones for this UnESS AO.

Announcement of Opportunity release	August 2, 1999
Questions for the Preproposal Conference	September 1, 1999
Preproposal Conference	September 10, 1999
Notice of intent due	October 20, 1999
Proposal submittal due by 4:30 p.m. EST	December 1, 1999
Non-U.S. Letter(s) of Endorsement due	January 15, 2000
Selections for Concept Studies (target)	February 2000
Award (target)	March 2000
Concept Studies Complete (9 months)	December 1, 2000
Downselect for Definition, Development and Flight	February 2001
Flights	2003 and/or 2004

2.0 Earth System Science Program

2.1 Earth Science Research Goals

The goals of the Earth Science Enterprise are to use the global perspective of observations from space to understand the planet as a complex, coupled system (involving the atmosphere, oceans, land and ice surfaces and the living biosphere), to enable an improved stewardship of our environment with sustained human progress through space observations, and the assessment and mitigation of the effects of natural disasters. A more detailed discussion of the goals, research and applications themes, and overarching science questions is included in Appendix A. These will form the basis of the science/applications evaluation criteria. For further information on the Earth science/applications research themes and questions may be obtained through the Internet URL address http://www.earth.nasa.gov.

By 2003, NASA will have made significant advances in space observations of the Earth system, launching eight missions in 1999 alone. Yet we will need continuing measurements of specific components of the Earth system as well as new measurements allowed by emerging technologies. We will conduct these measurements within a new NASA paradigm for space-borne projects that emphasizes small, focused missions to test hypotheses and address the scientific/applications themes. This new paradigm calls for a balanced program of space observations, airborne and ground-based measurements and modeling. Such a program will conceptually link and coordinate all aspects of the Earth Science Enterprise.

2.2 University Earth System Science (UnESS) Project Objectives

The goal of the UnESS Project is to foster the development of the next generation of Earth system scientists, engineers, managers, educators, and entrepreneurs through significant and meaningful hands-on student involvement in Earth observation space missions at the university level. For this UnESS AO, a student is defined as any

individual enrolled in an accredited university educational program with the documented intention of obtaining a degree. This project gives equal weight to the scientific/application and student involvement aspects. The scientific merit of the mission can be intrinsic to the mission itself or based on the value of the technology to future science/applications demonstrated through the mission. The student involvement aspects of the project seeks to have a diverse group of students, including those underrepresented in science and engineering fields, involved in hands-on experience with Earth observation missions. This experience should include preparation of proposals through analyzing and distributing the data to the scientific/applications community. The UnESS Project encourages broad participation from multiple university schools (e.g., science, engineering, aerospace management, business, journalism, education, graphic and fine art, law, communications). The Office of Earth Science encourages proposals with meaningful participation of Historically Black Colleges and Universities (HBCU), Other Minority Universities (OMU) including Hispanic serving institutions and Tribal colleges and universities.

3.0 University Earth System Science Project Requirements, Constraints, and Guidelines

This section describes the requirements, constraints, and guidelines applicable to all UnESS Project selections. Appendix B gives the general instructions and provisions that will be applied to this AO. Specific directions for proposal preparation and submission are included in Appendix C and Section 4.

3.1 General Project Requirements, Constraints and Guidelines

Overall UnESS mission responsibility is vested with the selected Principal Investigator (PI) and team, with limited NASA oversight. The PI is responsible to NASA for the scientific integrity of the mission, as well as the management of the complete mission, including provision of the spacecraft, instrument, ground system, and arranging the launch service. Investigators can be from universities, industry, nonprofit institutions, NASA Centers, Federally Funded Research and Development Centers, other Government agencies, or foreign organizations. Co-Investigators must have an identified role in the proposal, play a defined and necessary role in the investigation, and covered in the funding plan. Mission teams are encouraged to include minority students, and investigations are encouraged to include Historically Black Colleges and Universities (HBCU) and Other Minority Universities (OMU) as full participating team members. The aerospace industry is encouraged to support participating universities by establishing mission mentorship programs based on their expertise and by providing contributions to the missions.

Investigations are capped at a maximum of $15 million in NASA Earth Science Enterprise funding. This is a cap in funding, not a guide, and those proposals that are proposed at the cap will not be able to adjust upward during the Concept Study. Outside contributions to the mission are encouraged but are not required and there are no limits

on the extent of those contributions. Contributions can be of cash, property or services on a no-exchange-of-NASA-funds basis. NASA civil service or NASA contractor resources may not be contributed unless separately funded by a complementary effort. However, see Section 3.12 for another funding option for HBCU/OMU participation.

Once an investigation has been selected for flight, failure to maintain reasonable progress on an agreed upon schedule or failure to operate within the constraints outlined in this AO may be cause for its termination by NASA. Every aspect of a selected investigation must reflect a commitment to mission success while keeping total costs as low as possible. Consequently, investigations should be designed and planned to emphasize mission success within cost and schedule constraints by incorporating sufficient margins, reserves, and content resiliency. UnESS mission teams will not only be responsible for the flight hardware but will also be responsible for initial analysis of the data including calibration and validation, its subsequent delivery to an appropriate data repository, the publication of scientific findings, and communication of results to the public. Only those investigations for which proposed cost, schedule, and launch vehicle requirements do not exceed the constraints and guidelines identified herein will be considered as candidates for selection.

3.2 Mission Options

This AO solicits only end-to-end investigations, which begins with concept definition, includes spaceflight hardware development, and ends with delivery of the data products to the scientific community. A PI may propose one of two mission types. For the complete flight mission the PI proposes a mission where the instrument is the primary payload on the spacecraft and launch vehicle. The PI may also propose a partial mission where the instrument is a secondary payload on another mission. In either case your proposal must identify, describe and include the costs of instrument carriers, launch vehicles, and services. Depending on the mission type several options exist for launch services. These are described in Table 3.2-1 below.

Space Shuttle launch services and standard Shuttle and International Space Station (ISS) Services will be provided by NASA as Government Furnished Equipment (GFE) and services at no cost to the investigation and are not considered within the NASA Earth Science Enterprise funding cap. If the proposed shuttle mission requires new hardware or modifications to existing hardware those cost must be costed in the proposal. All safety and integration cost must be included in the proposal. If PI proposes to obtain their own instrument carrier and/or launch vehicle, the demonstrated reliability of the proposed systems will be evaluated. Each proposal must identify the planned launch opportunity and provide documentation that the launch service provider agrees to manifest the mission.

Table 3.2-1 Launch Service Options.

Mission Type	Science	Instrument Carrier	Launch Vehicle	Launch Service Provider	Launch Service Cost
Complete Flight Mission	Instrument	Own Free-Flyer S/C	ELV	Commercial	If Contributed
				NASA	Not an Option
			Shared ELV	PI gets	Must be Costed
				NASA gets	Must be Costed
			Space Shuttle	NASA or PI gets	$0*
		Spartan	Space Shuttle	NASA or PI gets	$0*
Partial Mission	Instrument	Space Station (Attached Payload or Optical Window)	Space Shuttle	NASA	$0*
		Space Shuttle (Cargo Bay)	Space Shuttle	NASA	$0*
		Somebody else's S/C	Provider's launch vehicle	Commercial, Gov't, Foreign	Must be Costed

*Not all integration costs are covered. See Section 3.2 for details.

Standard integration costs, as defined in the ISS UnESS Research Opportunities document in the UnESS Project Library, are provided at no cost. Payload unique integration costs and safety costs must be included in the proposal. The Shuttle carriers for ISS payloads will be provided by the ISS program at no cost. The EXPRESS Pallet launch opportunities are manifested for late 2003. The first opportunity to launch payloads intended for the Window Observational Research Facility (WORF) will be in late 2001.

3.3 International Participation

Recognizing the potential scientific, technical, and financial benefits offered to all partners by international cooperation, participation by non-U.S. individuals and organizations as team members in UnESS investigations is welcome. Participation may include, but is not limited to, the contribution of scientific instruments, the spacecraft (or a portion thereof), and the subsequent sharing of the data from the mission, all on a no-exchange-of-NASA-funds basis. Carriers, launch vehicles and launch services, and space operations may also be contributed by international partners and must be included in all calculations and discussions of the Total Mission Cost which is defined in Appendix C.

Subject to the FAR provisions set forth in Appendix E, the direct purchase of goods and/or services from non-U.S. sources is permitted except for the following restriction: NASA is precluded from purchasing non-U.S. launch vehicles, nor may NASA funds provided to a mission team be used to purchase a launch vehicle from a non-U.S. source. The provision of launch services as a contribution to a UnESS mission by a non-U.S. partner is acceptable only on a no-exchange-of-NASA-funds basis (i.e., at no cost to NASA). Only those non-U.S. launch vehicles with demonstrated reliabilities may be proposed for UnESS missions.

Proposers are advised that a contract or subcontract by a U.S. team with a non-U.S. participant using funds derived from NASA must meet NASA and Federal regulations. Proposers are further advised that these regulations will place an additional burden on mission teams that should be explicitly included in discussions of the investigation's cost, schedule, and risk management. Information regarding regulations governing the procurement of foreign goods or services is provided in Appendix E.

Proposers for non-NASA, non-U.S. missions should recognize that all such proposals must be consistent, and in compliance with, all U.S. Government laws, regulations, and policies governing the export of hardware and/or technical data. Further, any such successful proposal will require the appropriate agreement(s) and export license(s). Therefore, all proposers for non-U.S. missions should contact the Earth Science Division, Office of External Relations, at NASA Headquarters at the address in Section 4.3.1 during the preparation of the concept study to obtain information about U.S. Government laws or policies (e.g., export control), as well as NASA policy and procedures regulating international cooperation that may be relevant to the proposal.

Participation by non-U.S. individuals and/or institutions as team members or contributors to UnESS investigations must be endorsed by the institutions and/or governments involved. Institutional endorsement is required for contributions. If government support is required then a government endorsement is also needed. The letter of endorsement must provide evidence that the non-U.S. institution and/or government officials are aware and supportive of the proposed investigation and will pursue funding for the investigation if selected by NASA. Such endorsements must be submitted per the schedule in Section 1.3 and in compliance with the provisions of Sections 3.1 and 4.3.1.

4.0 Proposal Preparation and Submission

4.1 Preproposal Activities

4.1.1 University Earth System Science Project Library

The UnESS Project Library is a resource that was created to provide requirements and background information on the UnESS project, including science/applications goals, technology and education/outreach strategies, and background information on management aspects of flight programs. Additional information on the UnESS Project Library is contained in Appendix D.

4.1.2 Technical and Scientific Inquiries

Inquiries of a technical nature should be directed to the UnESS Project Executive, at the address below. Inquiries of a scientific nature should be directed to the UnESS Project Scientist, at his address below. Inquiries are preferred in writing and may be sent via fax

or E-mail (preferred). The character string "UnESS-AO" (without quotes) should be included in the subject line of all E-mail transmissions.

UnESS Announcement of Opportunity
Ref: AO-99-OES-02
University Earth System Science Support Office
Jorge Scientific Corporation
400 Virginia Avenue SW, Suite 700
Washington, DC 20024
Fax Number: 202-554-3024
E-mail: mdonnell@hq.nasa.gov
Phone: 202-544-2775

4.1.3 Preproposal Conference

A preproposal conference will be held in the Baltimore, MD/Washington, D.C. area on September 10, 1999. When the details of the time and location of the preproposal conference have been finalized, the information will be posted at URL (http://uness.larc.nasa.gov/uness). Ms. Melissa Donnelly may also be contacted for details on the conference:

Phone: 202-544-2775
Fax: 202-554-3024
E-mail: mdonnell@hq.nasa.gov

Attendees are to attend at their own expense and to make their own travel arrangements. The purpose of this conference will be to address questions about the proposal process for this AO. The preproposal conference will address all those questions received by NASA on or before September 1, 1999. Questions should be addressed to the UnESS Project Executive at the address given in Section 4.1.2. Additional questions submitted after this date, including those provided in writing at the conference, may be addressed at the conference only as time permits. Anonymity of the authors of questions will be honored if requested. A University Earth System Science AO Preproposal Conference Transcript, including answers to all questions addressed at the conference, will be prepared and posted in the UnESS Library (http://uness.larc.nasa.gov/uness) approximately two weeks after the conference. If you require a paper copy of the transcript please contact the University Earth System Science Support Office at the address above.

4.1.4 Notice of Intent to Propose

To assist NASA's planning of the proposal evaluation process, a Notice of Intent (NOI) should be submitted by all prospective proposers in accordance with the schedule in Section 1.3. This Notice must be typewritten in English and may be submitted in one of the following four ways:

By the Internet:

The form to submit an NOI can be found on the Internet at :
http://uness.larc.nasa.gov/uness (or)
http://bhuma.earth.nasa.gov/loi/form.cfm

Please follow the instructions carefully. The information will be submitted to a secure database.

or by E-mail to:

<mdonnell@hq.nasa.gov>, with Subject designated as <UnESS NOI - (PI Name)>

or by FAX to:

University Earth System Science Support Office
202-554-3024

or by mail to:

University Earth System Science Support Office
Jorge Scientific Corporation
400 Virginia Avenue SW, Suite 700
Washington, DC 20024

Acknowledgment of receipt of Notices of Intent (NOIs) will be made within two weeks of the due date for NOIs. To the extent the following information is known, the Notice of Intent should include:

(a) Names, addresses, telephone numbers, E-mail addresses, and fax numbers (1) of the Principal Investigator; (2) any Co-Investigators; and (3) the lead representative from each organization (industrial, academic, educational, not-for-profit, Federal, and/or Foreign) expected to be included in the proposal team;
(b) Title of the proposed investigation, a brief statement of the scientific/applications and student involvement objectives, and the primary NASA science/applications theme and question (see Section 1.1 and Appendix A) that the investigation supports whether complete or partial mission;
(c) Spacecraft (state if own) and launch vehicle to be proposed;
(d) Identification of any new technologies that may be employed as part of the mission; and
(e) A brief statement describing the education/public outreach objectives in the proposed investigation.

Material in a NOI is for NASA planning purposes only, is confidential, and is not binding on the submitter.

SPECIAL NOTICE: As a result of recent AOs for complete mission investigations such as this one, commercial aerospace and technology organizations have requested access to the names and addresses of those who submit NOIs in order to facilitate informing

potential proposers of their services and/or products. At the option of the submitters of an NOI, NASA Office of Earth Science is willing to offer this service with the understanding that the Agency takes no responsibility for the use of such information. Therefore, all those submitting an NOI in response to this AO are requested to include the appropriately edited form of the following (note: this is also included in the format of the NOI for those submitting electronically via the World Wide Web):

> By submitting this Notice of Intent to propose, I hereby do/do not authorize NASA to post my name and institutional address (but not the name of my intended proposal) as an addendum to this AO on the World Wide Web. If I do authorize such a posting, I understand that such information will be in the public domain, and I will not hold NASA responsible for any use made by others for revealing this information.

4.2 Format and Content of Proposals

General NASA guidance for proposals in general is given in Appendix B. A uniform proposal format is required from all proposers to aid in proposal evaluation. The required proposal format and contents are summarized in Appendix C. Failure to follow this outline may result in reduced ratings during the evaluation process, or in extreme cases, could lead to rejection of the proposal without review.

4.3 Submission Information

4.3.1 Endorsements

The proposal must be signed by an official of the Principal Investigator's institution authorized to certify institutional support and sponsorship of the investigation, and the management and the financial parts of the proposal.

The original copy of all proposals shall include a letter of endorsement from all organizations offering goods and/or services on a no-exchange-of-NASA-funds basis, NASA Centers, other government agencies, non-U.S. organizations providing hardware or software to the investigation, the major participants in the proposal, and the launch service provider if the launch service is not provided through NASA. Letters of endorsement should be signed by institutional or Government officials authorized to commit their organizations to participation in the proposed investigation. These officials must certify institutional support and sponsorship of the investigation, as well as concurrence in the management and financial parts of the proposal. Non-U.S. organizations must also submit such endorsements to Ms. DeVon Carroll at the address below with a copy to the University Earth System Science Support Office at the addresses given in Section 4.1 by the due date given in the schedule in Section 1.3.

Ms. DeVon Carroll
Earth Science Division
Code IY
Ref: University Earth System Science (UnESS) AO 1999
National Aeronautics and Space Administration
Washington, DC 20546-0001
USA
Phone: 202-358-0793
FAX: 202-358-2798

4.3.2 Electronic Version of Proposal

Include with your proposal diskettes containing electronics version of your proposal, along with a brief description of the contents of the diskettes, as described in Appendix C. The diskettes will be used primarily to assist evaluators with searches for information within the proposal. The actual evaluation will be performed utilizing the paper version as submitted.

4.3.3 Quantity

Proposers must provide thirty (30) copies of their proposal, plus the original signed proposal, and three copies of the diskettes and diskette content description, on or before the proposal deadline given in Section 1.3.

4.3.4 Submittal Address

All proposals must be received by 4:30 p.m. Eastern Standard Time on the day in the schedule in Section 1.3, at the following address:

University Earth System Science 1999 Support Office
Jorge Scientific Corporation
400 Virginia Avenue SW, Suite 700
Washington, DC 20024

Point of contact for commercial delivery: Ms. Melissa Donnelly; phone: 202-554-2775

Furthermore, one copy of any proposal that includes any non-U.S. participants and/or institutional and governmental commitments must be sent to Ms. DeVon Carroll at the address listed in Section 4.3.1.

4.3.5 Deadline

All proposals must be received at the address above by the closing date specified in Section 1.3. All proposals received after the closing date will be treated in accordance with NASA's provisions for late proposals (Appendix B, Section VII).

4.3.6 Notification of Receipt

NASA will notify the proposers in writing that their proposals have been received. Proposers not receiving this confirmation within two weeks after submittal of their proposals should contact the UnESS Project Executive at the address given in Section 4.1.2.

5.0 Proposal Evaluation, Selection, Debriefing, and Implementation

5.1 Evaluation and Selection Processes

NASA will subject all proposals submitted in response to this AO to a Concept Study Selection Process. Those proposals selected for Concept Study funding will also undergo a Downselect Process at the completion of the studies. NASA will apply these processes and the evaluation criteria to all aspects of the proposal, regardless of the funding source. NASA will evaluate how well the proposal satisfies the requirements of this AO, even for those aspects of the mission contributed by mission partners other than NASA.

5.1.1 Concept Study Selection Process

NASA will initiate the Concept Study Selection Process with a preliminary screening. Proposals that, during the preliminary screening, NASA finds not in compliance with the requirements, constraints, and guidelines of the AO will be returned to the proposer without further review. A debriefing can be requested according to the guidelines in Section 5.5.

Proposals that pass the preliminary screening will be assessed in the Concept Study Selection Process against the criteria given in Sections 5.2.1 through 5.2.6 by two panels of individuals who are peers of the proposers and/or their mentors (we are not currently planning to use student evaluators for this AO). The Science/Applications and Student Involvement Panel and sub-panels will evaluate the proposals based upon the criteria in sections 5.2.1 and 5.2.2. The Technical, Management, Cost and Other Opportunities (TMCO) Panel and sub-panels will evaluate the proposals based upon the criteria in sections 5.2.3 through 5.2.6. These panels and sub-panels will be instructed to evaluate all proposals independently and not to compare larger missions with smaller ones. The panels may be augmented through the solicitation of mail-in reviews, which the panels have the right to accept, modify, or reject. Proposers should be aware that during the evaluation and selection process, NASA might request clarification of a specific point or points in a proposal. Such a request and the proposer's response shall be in writing. Once the Science/Applications and Student Involvement Panel evaluation and the TMCO Panel evaluation are complete, a UnESS Evaluation Executive Committee will convene to consider the peer review results from the two Panels. This committee will be chaired by the UnESS Project Executive and includes the UnESS Project Scientist as co-chair, the TMCO chair, an Education representative and other civil servants chosen by the committee chair. Once consensus is determined, the committee will categorize the

proposals in accordance with procedures required by NASA FAR Supplement Part 1872.0. These Categories are defined below. Note that NASA anticipates selecting and funding only Category I investigations.

- Category I. Well conceived and scientifically, technically, educationally sound investigation pertinent to the goals of the program and the AO's objectives and offered by a competent investigator from an institution capable of supplying the necessary support to ensure that any essential flight hardware or other support can be delivered on time and that data can be properly reduced, analyzed, interpreted, and published in a reasonable time. Investigations in Category I are recommended for acceptance and normally will be displaced only by other Category I investigations.
- Category II. Well conceived and scientifically, technically, or educationally sound investigations which are recommended for acceptance, but at a lower priority than Category I.
- Category III. Scientifically, technically, or educationally sound investigations which require further development.
- Category IV. Proposed investigations that are recommended for rejection for the particular opportunity under consideration, whatever the reason.

The UnESS Evaluation Executive Committee will also conduct an independent assessment of the evaluation and categorization processes regarding both, their compliance to established policies and practices, as well as their completeness, self-consistency, and adequacy of all materials related thereto. After this review, the final evaluation and categorization results will be reviewed with the Office of Earth Science Division Directors for comments and recommendations and then forwarded to the Associate Administrator for Earth Science who will make the final selections. Nominally six proposals will be selected for nine-month concept studies.

The Office of Equal Opportunity Programs will then conduct an independent and separate evaluation of the selected proposals for significant and meaningful participation by Historically Black Colleges and Universities and Other Minority Universities (HBCUs/OMUs) for additional direct funding to the HBCUs/OMUs. This evaluation will use the criterion in Section 5.2.7, and not influence the concept study selections.

Selected proposers will be notified by phone and then by letter and provided with instructions for initiating their concept study. Proposers not selected will be notified by letter and will be offered a debriefing (see Section 5.5).

The selected proposers will conduct nine-month concept studies, culminating in the Concept Study Reports, which will be used as the basis for the Downselect Process.

5.1.2 Downselect Process

Once the nine-month concept studies are complete and the Principal Investigators have submitted their Concept Study Reports, NASA will conduct a Downselect Process to

select two or more mission for flight, subject to the available funding and the cost of the selected missions.

NASA will initiate the Downselect Process with a preliminary screening. Concept Study Reports that, during the preliminary screening, NASA finds not in compliance with the requirements, constraints, and guidelines of the AO and the Concept Study Report Guidelines will be returned to the proposer without further review. The final NASA Earth Science Enterprise estimated cost in the Concept Study Report cannot exceed the initial, proposed NASA Earth Science Enterprise estimated cost by more than 20 percent or the funding cap, whichever is less. Missions will not be considered in the Downselect Process unless the Concept Study Report has been submitted on time. Information concerning the format and content of the Concept Study Report can be obtained from the *Office of Earth Science Guidelines for Concept Study Report Preparation* in the UnESS Library at http://uness.larc.nasa.gov/uness.

NASA will conduct the Downselect evaluations according to the same evaluation criteria used in the Concept Study Selection Process described in Sections 5.2.1 through 5.2.6. However, this review will reflect the greater level of detail and design maturity enabled by the increased page count, elapsed time, and Concept Study support. This in-depth downselect review will evaluate the implementing details of the selected investigations, including the following:

- Any modifications to the student involvement and scientific/applications objectives,
- Design details of the experiment hardware,
- Plans for mission implementation including technical and management factors,
- Plans for new technology (as appropriate) and its risk mitigation plan,
- Subcontracting approach plan, when appropriate, and
- Plans for participation of HBCU/OMU and Small Disadvantaged Business, commercialization and education and public outreach including students and faculty of HBCU/OMU.

The Concept Study Report will be used to determine the investigation's readiness to proceed. The investigation must demonstrate satisfactory technical, cost and schedule performance, as well as the capability to achieve the originally proposed student involvement and scientific objectives. The Downselect Process will select two or more missions for mission definition. Pending a Mission Confirmation Review, these selected missions can proceed to mission development and flight.

Following downselection, the Principal Investigators of the investigations selected for flight implementation will be notified by telephone, followed by formal written notification. The formal notification will include any issues noted during the evaluation that may require resolution and any special instructions for the concept study. A Project Initiation Conference will be held as soon as possible after selection to clarify requirements and responsibilities of all parties having roles in the mission, including launch service personnel. Proposers of investigations that were not selected will be

notified in writing and offered a debriefing by phone or in person. Results of this downselect review and a decision to proceed (or not) will be provided within 30 days of the review.

5.2 Evaluation Criteria

The evaluation criteria listed below will be used to evaluate proposals as described in Section 5.1. All proposals deemed to be compliant would be evaluated and categorized against these criteria. In addition, these criteria will also be used in the Downselect Process. The six criteria cover:

- The Scientific/Applications merit
- The degree of Student Involvement
- The Technical Implementation plan
- The Management plan
- The Cost and Cost Realism
- The Other Opportunity plan

The scientific/applications merit and student involvement evaluation criteria will be evaluated giving equal weight. The technical implementation, management implementation, and cost and cost realism criteria are risk factors, of equal weight, and are of secondary importance to the first two criteria. The other opportunity criterion is of lesser importance to all other criteria. After selection, for those proposals that request Office of Equal Opportunity Programs funding during the concept study phase, the Office of Equal Opportunity Programs will conduct an independent and separate evaluation of the selected proposals using the following evaluation criterion. This funding is only available for use during the concept studies and, therefore, this criterion will not be not be used during the Downselect Process.

- The degree to which the proposal meets the requirements of increasing the capabilities of HBCUs/OMUs to participate in Earth science/applications missions.

The science and applications, student involvement, other opportunities, and Office of Equal Opportunity Programs criteria are measurements of quality and NASA will assign adjectival ratings as shown in Table 5.2-1. The technical implementation, management, and cost criteria are measures of implementation feasibility and NASA will assign risk ratings as shown in Table 5.2-2. For these latter criteria, a factor can outweigh all others if it jeopardizes overall mission success.

Table 5.2-1 Adjectival Ratings for Science/Application, Student Involvement and Other Opportunity Merit.

Adjective	Definition
Excellent	A comprehensive and thorough proposal of exceptional merit. One or more major strengths. No major weaknesses or only minor correctable weaknesses.
Very Good	Demonstrates overall competence. One or more major strengths and strengths out balance any weaknesses. Any major weaknesses are correctable.
Good	Reasonable sound response. There may be strengths or weaknesses, or both. As a whole, weaknesses, not offset by strengths, do not significantly detract from the offeror's response. Major weaknesses are probably correctable.
Fair	One or more weaknesses. Weaknesses have been found that out balance strengths. Major weaknesses can probably be improved, minimized, or corrected.
Poor	One or more major weaknesses which are expected to be difficult to correct, or are not correctable.

5.2.1 Scientific/Applications Criterion

NASA will use the following to evaluate the Science/Applications Criterion.

- The overall scientific and/or applications merit of the proposed investigation, as measured by
  - The scientific or applications objectives and justification of the proposed investigation. The scientific or applications justification can be based upon the results expected from the mission as proposed, or based on the potential for future results based upon the technology or technique demonstrated by the proposed mission. Proposals whose justification is based upon a future capability must include a plan or "roadmap" describing how the demonstration will lead to the full mission including likely funding sources for the full mission (i.e., commercial, current or planned NASA programs, etc.). NASA will assess the likelihood that the flight demonstration will lead to a successful full mission.
  - The coherence of the traceability from the proposed objectives to the measurements required to the instrument functional requirements and the instrument/mission engineering requirements.
  - The scientific resilience of the investigation, as reflected by the assessment of proposed descope options and the sensitivity to and likelihood of reduced performance or shortened mission life.

Table 5.2-2 Risk Ratings for Technical Implementation, Management, and Cost

Adjective	Definition
Low Risk	No major weaknesses. No problems that can't normally be overcome within proposed resources. Problems not of sufficient magnitude to make us uncomfortable about the ability of investigation to be implemented within its envelope.
Medium Risk	Reasonably sound response. There may be strengths or weaknesses or both. As a whole, weaknesses that are not offset by strengths do not significantly detract from the offeror's response. Major weaknesses are correctable. Examples: • Problems are not so significant that the team can't overcome them with good management (as proposed) and application of engineering resources; or • Although technology is not sufficiently ready, there is reasonable probability that the investigation can be implemented within proposed cost and schedule; or • Complexity is inherently risky but not too risky; or • Resources are very tight but doable (envelope tight).
High Risk	Major weaknesses are not correctable within proposed resources. Expect failure; the investigation does not have sufficient envelope.

- The relevance of the proposed investigation to the Earth Science Enterprise and its science and application priorities and the goals and objectives of the UnESS project.
- The uniqueness and innovation of the proposed investigation. This will include the relationship between the proposed investigation and other approved Earth Science missions including NASA, other government, international, and commercial missions. Missions that duplicate other capabilities must justify this duplication showing that they:
  - demonstrate an innovative approach to replace the planned capability
  - complement or extend the planned capability
- The feasibility of the proposed investigation, including maturity of the underpinning research, the feasibility and risk of achieving objectives based on the proposed instrumentation and technical implementation, the risk that the investigation will not meet the objectives as proposed. For the initial selection, this will include an assessment that the major science/applications issues will be resolved by completion of the Concept Study. For the downselect the Mission Confirmation Review, this will include an assessment that the major science/applications issues will be resolved by completion of the Mission Confirmation Review. Note: NASA will assess the capability of the proposed measurement to achieve the objectives under the Science and Applications criterion, and will assess the capability of the proposed

instrument to achieve the proposed measurement under the Technical Implementation criterion.

- The expertise and experience of the senior members and mentors for the science and applications team in relation to the proposed science or applications objectives.
- The adequacy of the correlation measurements and validation activities
- The adequacy of the data processing and distribution plan, including analysis, archiving, and dissemination of data and results.
- Compliance with the guidelines and requirements of the AO (for initial proposal) and Concept Study (for downselect).
- Adequacy and likelihood of success of plans to resolve outstanding science or applications issues by the completion of the Concept Study (for initial selection only) and/or the Mission Confirmation Review.

5.2.2 Student Involvement Criterion

NASA will use the following to evaluate the Student Involvement criterion.

- Extent of hands-on involvement in all phases of the mission by a diverse group of students, including those underrepresented in science and engineering fields, in certified degree programs at the undergraduate and graduate level.
  - Breadth of student involvement, such as:
  - science students
  - engineering students
  - other academic disciplines, such as business, journalism and communications, graphic/fine art, education, law, etc.
  - Plans to attract and involve under represented minority students
- Educational and academic impact of student involvement, including any innovative features that will extend the impact beyond the immediate mission team.
- Quality, scope, and realism of the proposed student involvement, including oversight and mentoring plans, capability and commitment of mentors
- Compliance with the guidance and requirements of the AO (for the initial proposal) and the Concept Study Guidelines (for the downselect).
- Adequacy and likelihood of success of plans to resolve outstanding student involvement issues by the completion of the Concept Study (for initial selection only) and/or the Mission Confirmation Review.

5.2.3 Technical Implementation Criterion

NASA will use the following to evaluate the Technical Implementation criterion.

- Mission design, including adequacy, achievability, completeness, and traceability to high level objectives and constraints both.

- Spacecraft hardware and flight software including reliability, risk technical maturity, development schedule, performance margins, spacecraft maturity matrix.
- Instrumentation: Note: NASA will assess the capability of the proposed measurement to achieve the objectives under the science and applications criterion, and will assess the capability of the proposed instrument to achieve the proposed measurement under the technical implementation criterion.
- Instrument Interface and Payload Integration: including definition, clarity, and simplicity of interfaces and the consistency between the requirements and constraints of the spacecraft and the instrument.
- Launch vehicle: reliability, compliance with NASA policy
- Manufacturing, Integration, and Test; including schedule, facilities, test planning (Hardware, software, environmental, lifetime) or adequacy of design if testing not proposed, integration to the launch vehicle.
- Ground and data systems including adequacy and completeness of proposed approach, software development, data processing approach, testing, use of appropriate standards, and spectrum allocation requirements and approach.
- Mission Operations; including adequacy and completeness of approach, facility requirements (new or existing), security and redundancy.
- Compliance with the guidance and requirements of the AO (for the initial proposal) and the Concept Study Guidelines (for the downselect).
- Adequacy and likelihood of success of plans to resolve outstanding technical implementation issues by the completion of the Concept Study (for initial selection) and/or by the Mission Confirmation Review.

5.2.4 Management Criterion

NASA will use the following to evaluate the Management criterion.

- Management processes and plans, schedules and procurement strategy, including:
  - Decision making process
  - Internal reviews and control
  - External reviews, NASA audits and insight.
  - Schedule and work flow
  - Procurement strategy, plan, major subcontracts, and agreements
  - System Engineering
  - Document Tree
- Team organization and structure, including:
  - Clarity of proposed roles and responsibilities
  - Clarity of lines of authority
  - Commitment of key personnel, including principal investigator, project manager and systems engineer, their institution, and their mentors (if students).
  - Experience of key personnel and their mentors as appropriate
  - Documented Agreements and signatures for key mission elements

  - Plans for physical accommodations (co-location of team, etc.)
- Cost and Risk Management Plan, including insight and control of:
  - Schedule margins (funded)
  - Performance margins
  - Budget reserves
  - Descope options (including decision dates and resource savings)
  - Identification of risks, and risk mitigation strategies
  - Linkage between level of risk and all overall margins and reserves as a function of schedule or mission development phase.
  - Cost management and tracking (expected vs. actual, etc.)
- Mission Assurance and Safety, including:
  - Compatibility with ISO 9000 or industry best practices
  - Problem/failure reporting system
  - Inspection and quality control plans
  - System level verification (ground and/or space)
  - System safety assurance
  - Software validation
  - Parts selection and control
  - Reliability analysis and identification of failure modes and single point failures
  - Management of the cost of quality
- Facilities and Equipment, including:
  - Identification of major facilities and equipment required (both existing and new)
  - Commitment that major facilities and equipment will be available within schedule and budget
- Compliance with the guidance and requirements of the AO (for the initial proposal) and the Concept Study Guidelines (for the downselect).
- Adequacy and likelihood of success of plans to resolve outstanding management implementation issues by the completion of the Concept Study (for initial selection) and/or by the Mission Confirmation Review.

5.2.5 Cost and Cost Realism Criterion

NASA will use the following to evaluate the Cost and Cost Realism criterion.

- Cost Validity, including:
  - Basis, heritage and quality of proposal cost estimates, particularly for the spacecraft (if appropriate) and instrument(s)
  - Realism of the proposed budget
  - Clarity and completeness of the proposed work breakdown structure (WBS)
  - Cost estimating methodology
- Cost Risk, including:
  - Adequacy of proposed Reserves
  - Understanding of required resources and risks demonstrated in proposal

  - Linkage between technical and schedule risks, reserves (performance, budget, and schedule), and descope options
  - Past cost performance of major partners (if appropriate)
- Total Cost to the Earth Science Enterprise
- Compliance with the guidance and requirements of the AO (for the initial proposal) and the Concept Study Guidelines (for the downselect).
- Adequacy and likelihood of success of plans to resolve outstanding cost and cost realism issues by the completion of the Concept Study (for initial selection) and/or by the Mission Confirmation Review.

5.2.6 Other Opportunity Criterion

NASA will use the following to evaluate the Other Opportunity criterion. NASA recognizes that the low cost of the investigations solicited by this AO may not allow the proposed investigation to address all of these.

- Educational outreach (over and above student involvement in the mission)
  - Plans for hands-on involvement of other students in the - (high school, non-degree, etc.)
  - Impact on Formal Education System
    > Teacher Workshops
    > Science missions
  - Impact on minority student education
    > Increased performance in foundational mathematics, science and technology courses, such as algebra, biology, geography, introduction to computing
    > Increased enrollment in advanced mathematics, science and technology courses, such as calculus, physics, chemistry, computer programming, and computer information systems
    > Increased enrollment in college and university NASA-related degree programs
  - Plans for measuring and evaluating the above impacts
- Public outreach
  - Plans to enhance public understanding of Earth science/applications activities
  - Innovation of the public outreach approach, and its potential to excite and involve the public
  - Plans for measuring and evaluating the above impacts
- Plans for significant participation (the NASA Agency-wide goal is 8% participation) in the mission team by:
  - Historically black colleges and universities (HBCUs) and other minority universities (OMUs)
  - Small businesses small disadvantaged businesses, and women-owned small businesses
- Commercial opportunities:
  - Identification and consideration of commercialization opportunities

- Realism and viability of commercialization plans

5.2.7 Office of Equal Opportunity Programs Minority University Research and Education Programs Funding Evaluation Criterion

If Office of Equal Opportunity Programs funding is requested, the Office of Equal Opportunity Programs Minority University Research and Education Programs Funding section will be evaluated for significant and meaningful participation by Historically Black Colleges and Universities and Other Minority Universities (HBCUs/OMUs). The plans for participation of HBCUs and OMUs described in the proposal will be evaluated by their quality and credibility and the degree to which they propose to augment their capacity to participate in Earth science/applications missions and carry out more significant roles and responsibilities. HBCUs/OMUs participation will also be evaluated on the extent to which the HBCU/OMU participation is integral to the mission and is based on the capability and relevant expertise of the HBCUs and/or OMUs involved. The items proposed under the Office of Equal Opportunity Programs funding would be evaluated on the extent that they are genuinely investments (as opposed to ordinary mission expenses), and that they provide long-term benefit to the HBCU/OMU.

The specific evaluation criteria against which a proposed activity will be judged are:

- The degree to which the proposed effort contributes to an effective, long-duration partnership that leads to an increase in the training of, involvement in, and broad understanding of Earth science/applications missions by students underrepresented in Science, Mathematics, Engineering and Technology.
- The quality, scope, and realism of the proposed effort to benefit the continued involvment of HBCUs and OMUs in earth science missions.
- The adequacy of plans for evaluating the effectiveness and impact of the proposed activity and the capability and commitment of the proposer to carry out the proposed program.
- The adequacy and realism of the proposed cost.

The Office of Equal Opportunity Programs will evaluate this section. The funding request shall not exceed $100,000 and shall be reported in this section and not included in the proposal cost section. This detailed funding request should be broken down to a level that will give evaluators sufficient information to determine the appropriateness of the request. These are additional funds that are separate and apart from the maximum $300,000 awards for concept studies and are not included in the funding limits. See Appendix C, Section K for more information.

5.3 Concept Study Selection Considerations

As described in Section 5.1 and 5.2, NASA will consider the results of the proposal evaluations, based on all the criteria described above, and the categorizations of the proposals, in the final Concept Study selection process. The scientific/applications merit and student involvement evaluation criteria will be evaluated giving equal weight. The

technical implementation, management implementation, and cost and cost realism criteria are of equal weight and are of secondary importance to the first two criteria. However, these three criteria are measures of implementation feasibility (risk), and the TMCO panel can recommend against selection of any proposal that fails to meet a minimum threshold. The other opportunity criterion is of lesser importance to all other criteria. In addition, the Selection Official will consider the total proposed Earth Science Enterprise Cost and programmatic issues in the final selections.

Proposers to this AO should recognize that the program of the Office of Earth Science is an evolving activity that critically depends upon U.S. Government policies and budgets, as well as Earth Science/applications objectives and priorities, any of which may change quickly with time. Therefore, it is incumbent upon the Associate Administrator of the Office of Earth Science to use all relevant science/applications planning, policy, and cost considerations when making selection(s) among top ranked proposals submitted in response to this AO. In addition, proposers to this AO are advised that it is an objective, but not a requirement that the final selections reflect a balance among the applicable scientific/applications research themes listed in Section 1.1 of this AO.

The overriding consideration for the final selection of proposals submitted in response to this AO will be to maximize scientific and educational return within the available budget. Depending on the availability of proposals of appropriate merit, NASA expects to select six investigations for 9-month Concept Studies. Each selected proposal will receive a maximum of $300,000 for the 9-month studies.

5.4 Downselect Considerations

As described in Section 5.1 and 5.2, NASA will consider the results of the Concept Study Report evaluations based on all the criteria described above in the final Downselect Process. The scientific/applications merit and student involvement evaluation criteria will be evaluated giving equal weight. The technical implementation, management implementation, and cost and cost realism criteria are of equal weight and are of secondary importance to the first two criteria. However, these three criteria are measures of implementation feasibility, and the TMCO panel can recommend against selection of any proposal that fails to meet a minimum threshold. The other opportunity criterion is of lesser importance to all other criteria. In addition, the Selection Official will consider the total proposed NASA Earth Science Enterprise cost and programmatic issues in the final selections.

Proposers to this AO should recognize that the program of the Office of Earth Science is an evolving activity that critically depends upon U.S. Government policies and budgets, as well as Earth Science/applications objectives and priorities, any of which may change quickly with time. Therefore, it is incumbent upon the Associate Administrator of the Office of Earth Science to use all relevant science/applications planning, policy, and cost considerations when making selection(s) among top ranked proposals submitted in response to this AO. In addition, proposers to this AO are advised that it is an objective,

but not a requirement that the final selections reflect a balance among the applicable scientific/applications research themes listed in Section 1.1 of this AO.

The overriding consideration for the final selection of proposals submitted in response to this AO will be to maximize scientific and educational return within the available budget. Depending on the availability of proposals of appropriate merit, NASA expects to select two investigations for flight implementation. The number of proposals selected during the downselect is dependent on the cost of the missions. For this reason proposals significantly under the NASA Earth Science Enterprise funding cap of $15 million for the proposed investigation are strongly encouraged.

5.5 Debriefings

Debriefings will be held at each of the major decision/selection points. NASA hopes and believes that the proposal preparation experience, followed by a thorough debriefing by the evaluation team will, of itself, offer educational benefit to the proposing teams. Depending upon the number of debriefings requested, these debriefings may be by mail, telephone, video conference, or conducted in person at NASA Headquarters. NASA recommends that representatives from all participating proposal disciplines participate in the debriefing. NASA has no funds to defray travel costs by the unsuccessful proposal teams for the debriefing. A downselect debriefing will be available at the end of the Downselect Process. Once again NASA recommends all disciplines be represented.

5.6 Award Administration, Management, and Funding

The NASA Headquarters Office of Earth Science shall provide the overall direction, funding and advocacy necessary to keep the UnESS Project a vital part of the Office of Earth Science program. NASA Headquarters Associate Administrator for Office of Earth Science shall make the initial investigation selections and the final downselections. Once the investigations are selected, the Earth Probes-G Program Office is the principal office responsible for management oversight of the UnESS Project including advance planning in support of program activities. Upon initial AO selection, an appropriate NASA center or institution will be assigned to the mission to serve as a science/technical NASA point-of-contact. This NASA center or institution should have scientific and technical expertise to support the mission if needed. The NASA point-of-contact will report through the Flight Facility University Class Project Office who will be responsible to the Earth Probes-G Program Office. The Earth Probes-G Program Office reports to the Office of Earth Science at NASA headquarters. This arrangement will continue for those missions selected to proceed after the Downselect Process.

At the end of the downselect process, the PI is committed to cost, schedule, and scientific performance. Failure to maintain progress on an agreed to schedule or failure to operate within mission constraints, guidelines or requirements may result in termination.

Different mission management approaches and organizational arrangements of the selected proposals may require different award mechanisms. For contracts, cost type

contracts with incentives should be considered, particularly where performance incentives are measured based on delivery of calibrated/validated science/applications data products. Selections may result in a contract award with options. However, NASA is not obligated to exercise any option. NASA may request presentations and/or site visits to review the progress of the investigation prior to exercising options.

6.0 Conclusion

The NASA Office of Earth Science announces the opportunity to conduct innovative space-borne Earth system observation investigations through the University Earth System Science Project. This Announcement of Opportunity is intended to foster the development of the next generation of Earth system scientists, engineers, managers, educators, and entrepreneurs through significant and meaningful hands-on student involvement in Earth observation space missions at the university level. This AO will give equal merit to the scientific/applications and student involvement aspects of the proposal. NASA invites both the U.S. and international scientific communities to participate in proposals for University Earth System Science investigations to be carried out as a result of this Announcement.

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Dr. Ghassem Asrar
Associate Administrator
Office of Earth Science

APPENDIX A

THE EARTH SCIENCE ENTERPRISE EARTH SCIENCE RESEARCH AND APPLICATIONS THEMES

The goals of the Earth Science Enterprise are to use the global perspective of observations from space to develop an understanding of the total Earth system and the effects of natural and human-induced changes on the global environment.

The program of the Enterprise will be guided by the following scientific themes:

- Biology and Biogeochemistry of Ecosystems and the Global Carbon Cycle
- The Global Water and Energy Cycle
- Climate Variability and Prediction
- Atmospheric Chemistry
- Solid Earth Science

In addition, the Enterprises fosters applications research and commercial developments aimed at more pragmatic issues including:

- Food and Fiber
- Natural Resources
- Disaster Management
- Environmental Quality
- Urban and Infrastructure
- Human Health and Safety

These themes are discussed in the sections below.

EARTH SCIENCE RESEARCH THEMES

1. BIOLOGY AND BIOGEOCHEMISTRY OF ECOSYSTEMS AND THE GLOBAL CARBON CYCLE

Earth's ecosystems are being subjected to human intervention and environmental changes on an unprecedented scale, in both rate and geographical extent. The ability of human societies to ameliorate, adapt to, or benefit from these rapid changes requires fundamental knowledge of the responses of terrestrial and marine ecosystems to global change. Also required is an understanding of the implications of changes in natural and managed ecosystems for increased food production, sustainable resource management, and the maintenance of a healthy, productive environment. As human societies seek to develop policies that respond to the impacts of global change, there will be a continuing requirement for objective, scientific information to understand the current impacts and predict the future effects of such policies. Presently there is an urgent need for

information on the sources and sinks of carbon dioxide in the environment and on the capacity of terrestrial and marine ecosystems to store carbon dioxide released to the atmosphere as a result of human activities.

NASA research on the biology and biogeochemistry of ecosystems and the global carbon cycle seeks to use remote sensing and related technologies to understand and predict how terrestrial and marine ecosystems are changing. This research theme addresses ecosystems as they are affected by human activity, as they change due to their own intrinsic biological dynamics, and as they respond to climatic variations and, in turn, affect climate. Emphasis is on understanding the processes and patterns of the Earth system that affect its capacity for biological productivity and the role of the Earth's biosphere in Earth system function. Documenting changes in land cover and land use is a priority. Understanding the distribution and cycling of carbon among land, ocean, and atmospheric reservoirs constitutes a major scientific focus for research as well as a new priority for interagency cooperation and international assessment. Questions that will drive this research include:

- **How do ecosystems respond to and affect global environmental change?**
- **How are land cover and land use changing? What are the causes and consequences?**
- **What is the role of ecosystems in the global carbon cycle and how might it change in the future?**

2. GLOBAL WATER AND ENERGY CYCLE

The recycling of water in the Earth atmosphere is the process that effects the renewal of fresh water on the planet, a unique feature in the solar system. The National Research Council report on *Research Pathways for the Next Decade – Overview* (NRC, 1998a) highlights the study of the global water cycle as one of the principal cross-cutting research themes that emerged from their review of the US Global Change Research Program: "Water is at the heart of both the causes and the effects of climate change. It is essential to establish rates of and possible changes in precipitation, evapotranspiration, and cloud water content. Better measurements are needed of water runoff, river flow and the quantities of water involved in various human uses." Indeed, any significant change in the global hydrologic regime could entail serious consequences in regions where water resources are already strained by the ever-increasing needs of human population, agriculture and industry.

In addition, the release of latent heat associated with precipitation is the principal source of energy that drive the atmospheric circulation and weather systems. Quantifying the global water cycle cannot be dissociated from the study of energy sources, sinks and transformations in atmospheric dynamics. Both water cycle and energy exchange processes are intimately linked to weather systems that evolve over periods of hours or days, and horizontal scales of 10-100 kilometers. Scientific progress in this domain is dependent upon the capability to observe these phenomena with appropriately high spatial and temporal resolution, handle the resulting large data flow.

A decade of planning and technology development has enabled NASA to embrace the spatial diversity and temporal variability of atmospheric phenomena, and address the basic connection between weather and climate (Chapter 2 of the EOS Science Plan: *Radiation, Cloud, Water Vapor, Precipitation and Atmospheric Circulation*; NASA, 1999). New space-based observing techniques, such as demonstrated by the Tropical Rain Measuring Mission and forthcoming EOS missions, will provide much enhanced knowledge of land vegetation and its role in evapotranspiration, cloud distribution and their role in the planetary radiation balance, precipitation and the role of latent heat in the development of weather systems. Field campaigns, conducted in environmentally sensitive regions such as the Amazonian rain forest and major watersheds like the Mississippi river basin, collect coordinated *in situ* and satellite measurements, and assemble reference data bases that will serve to constrain and test model computations for many years to come. Coupled atmospheric-hydrologic models are reaching the stage where they will be a powerful tool for environmental assessments and experimental hydrologic predictions.

This research theme emphasizes the concept of planetary-scale hydrology and climate linkages, introduced in National Research Council strategic planning studies such as *Hydrologic Sciences- Taking Stock and Looking Ahead* (NRC, 1998b). It builds upon the framework of the Global Energy and Water Cycle Experiment (GEWEX) in the World Climate Research Program, and the Biospheric Aspects of the Hydrological Cycle (BAHC) core-project in the International Geosphere-Biosphere Program. The goal of NASA is to lead a cooperative research effort, together with partner agencies in the US Global Change Research Program, and make key scientific contributions based on its unique capabilities for global observation from space, data analysis and Earth system modeling. The overarching objective is to improve the understanding of the global water cycle to the point where useful predictions of regional hydrologic regimes can be made. This detailed predictive capability is essential to deliver meaningful information for practical application to water resource management, and for validating scientific advances through the test of real-life predictions. Another, more fundamental, scientific objective is to improve the understanding of atmospheric energy exchange processes and their relationship to general circulation dynamics, so as to enable quantitative predictions of the response of the Earth climate to external forcing. Questions to be addressed by this research include:

- **Is the global water cycle accelerating?**
- **Can weather systems and hydrologic processes that control water resources be related to large-scale climate anomalies?**
- **Can the integrated effect of fast atmospheric and surface processes be accurately represented in large-scale model predictions of climate change?**

3. CLIMATE VARIABILITY AND PREDICTION

Climate variability encompasses regional-to-global scale transient variations that occur over periods of a season or longer and long-term trends. Variations include natural (intrinsic) variability that results from the internal dynamics of the climate system, as

well as forced changes resulting from the response of the climate system to changes in relevant external factors, such as radiation from the sun or greenhouse gases introduced by human activities. For the purpose of the NASA Earth science program, the climate system is defined as the global atmosphere, oceans, ice, and land surface, and physical interactions that occur between the components of this system. NASA recognizes that the response of the Earth climate and environment to various disturbances may involve a broader range of interactions, including geo-biochemical processes as well as changes in terrestrial and marine ecosystems. These complex interactions are discussed in chapter 6 on Interdisciplinary Earth System Science.

The NASA research program on Climate Variability and Prediction is consistent with the concepts and recommendations put forward in National Research Council reports on *Decade-to-Century-Scale Climate Variability and Change: A Science Strategy* (NRC, 1998a) and *Global Environmental Change: Research Pathways for the Next Decade – Overview* (NRC, 1998b). The research program focuses on the modes of variability that involve, in a fundamental way, the dynamics of the slower components of the physical climate system, the ocean circulation, snow and ice, that respond to external disturbances with greater inertia and, therefore longer "memories," than the atmosphere itself.

Research activities are focused on understanding the ocean circulation, air-sea exchanges, sea-ice processes, and the mass balance of polar ice sheet, as well as the long-term measurement of radiative forcing factors that can be monitored from space. NASA fully recognizes the role of the atmosphere and land in climatic variability and climate change. Improved understanding of atmospheric and hydrologic processes is a central objective of NASA's Earth system science research strategy.

This and the other components of the NASA Earth science program address the scientific priorities of the US Global Change Research Program at the national level and the World Climate Research Program (WCRP) in the international arena. NASA will continue to participate in the worldwide interdisciplinary research effort on climate change, in cooperation with other US and foreign agencies or institutions, and aims to make key contributions based on its unique capabilities for high-quality measurements from space, global data analysis and Earth system modeling. The overarching objective is to improve the understanding of climate mechanisms to the point where useful prediction of regional climate change can be made. Developing such understanding is also considered essential to enable reliable detection of climate trends and the attribution of forced climate changes to specific causal factors. To address the latter objective, NASA is prepared to participate with operational environmental agencies and other partner agencies in developing an Integrated Global Observing Strategy that can provide the required long-term systematic records of critical environmental measurements. Scientific questions to be addressed by this research include:

- **Is climate varying in ways we can understand and predict?**
- **Can the observed climate changes be related to specific causes or forcing factors?**

4. ATMOSPHERIC CHEMISTRY

The Earth atmosphere is the fluid that connects most effectively the other components of the Earth System –the oceans, the marine and terrestrial ecosystems, the geosphere and the cryosphere – and provides the medium in which these components interact. It is a chemically complex and dynamic mixture, the composition and structure of which represent a balance among competing processes. Changes to that balance, caused by natural phenomena or human action, can strongly influence life on Earth, either directly through changes in chemicals present in the atmosphere, or indirectly through coupling with other components of the Earth System. Atmospheric change is the result of strongly interactive chemical and physical processes. Atmospheric temperature, for example, depends on chemical composition, while the nature and rates of chemical processes depend on temperature. In other words, chemistry plays a role in determining weather and climate, while the physics and dynamics of the atmosphere influence chemical processes and composition. The overarching goals of the NASA Atmospheric Chemistry research program are to measure and understand how atmospheric composition is changing in response to natural and anthropogenic forcings, and to enable accurate prediction of future changes in ozone and surface ultraviolet radiation, climate, and global pollution. Questions to be addressed by this research include:

- **Is the Montreal Protocol working as expected to stop stratospheric ozone depletion by industrially produced chemicals?**
- **How is the distribution of trace constituents being affected by meteorological and chemical processes in the atmosphere?**
- **How much industrial and urban pollution will expand globally and with what consequences?**

5. SOLID EARTH SCIENCE

From a geophysical perspective, Earth is unique among terrestrial planets in that it is a dynamic system that contains abundant water and also supports life. Earth has profoundly evolved over the 4.5 billion years of its existence, constantly reforming its surface and overturning its interior with a vigor that is often disruptive to the life it supports. The basic structure of the Earth's interior was understood in some detail by the end of the 1930’s; it was known that the planet has a metallic core, surrounded by a mantle of dense minerals, then by a less dense crust, and finally by thin oceanic and atmospheric layers. Yet the fact that every one of these elements is in motion, manifesting a vast range of velocities over a diversity of scales, has only been known since the 1960’s. A fundamental question is whether Earth’s distinctive dynamism is a cause of the other unique features, the presence of liquid water and life, or a consequence of the former. To address this fundamental question, we must understand the mechanics of the Earth’s interior and surface, and governing mechanical, physical and chemical processes.

Observations made solely from the Earth’s surface had long hobbled scientific imagination. Gazing on quiet landscapes, the human perception of the Earth's dynamism was restricted to infrequent catastrophes - violent earthquakes, volcanic eruptions - or

low key but persistent erosion processes. Today, the global perspective from space offers a new outlook, a planetary reference frame from which to precisely determine the motion of the mantle, overturning as a ponderously viscous fluid; to observe the planet's magnetic field fluctuating with the turbulence of its liquid metal core; to measure changes in the length of day forced by ocean currents and global winds; to watch how continents strain in anticipation of an earthquake or volcanic eruption.

NASA's Solid Earth research program examines the dynamics of the solid Earth at virtually all spatial and temporal scales, and aims to establish the scientific basis for reconstructing Earth's past history and predicting its future evolution. The overarching goal is to observe and understand the fundamental properties and processes of Earth's interior and crust that make it dynamic. The same effort also provides essential information to guide decision-making on issues of great human import by illuminating society's vulnerability to natural hazards.

NASA's objective in this domain is to contribute to scientific understanding and provide technical leadership through pioneering space geodesy and remote sensing programs. The program requires highly accurate geodetic measurements to monitor the terrestrial reference frame, precise measurements of the static and time-dependent components of the Earth's gravity and magnetic fields, and observations of the Earth surface geologic nature, topography, elevation, and deformation with time. The program will improve the understanding of dynamical processes in the solid Earth and their interactions with other elements of the environment, including impacts on human societies and the assessment of vulnerability to natural hazards. In fact, the solid Earth science element is fully integrated with NASA's Natural Hazards program, as part of the overall "Solid Earth and Natural Hazard Program" of the Earth Science Enterprise. The scientific research effort is comprised of two major components: 1) understanding the fundamental geophysics and geodynamics of the Earth's interior; and, 2) understanding global geological processes that shape the topographic surface of the Earth. Scientific questions to be addressed include:

- **What are the motions of Earth's interior and what information can we infer about internal processes such as mantle convection and the generation of the Earth's magnetic field?**
- **How is the Earth's topographic surface being transformed and how can this knowledge be used to predict future changes?**

EARTH SCIENCE APPLICATIONS THEMES

Applications themes are similar in concept to the high-level science themes and questions that drive the scientific research in the Earth Science Enterprise as described above. The major difference is that the applications themes are defined by public and private sector markets and necessities, and not scientific curiosity. The applications research may lead to operational or commercial activities in other agencies and/or industry and therefore have a substantial benefit to society.

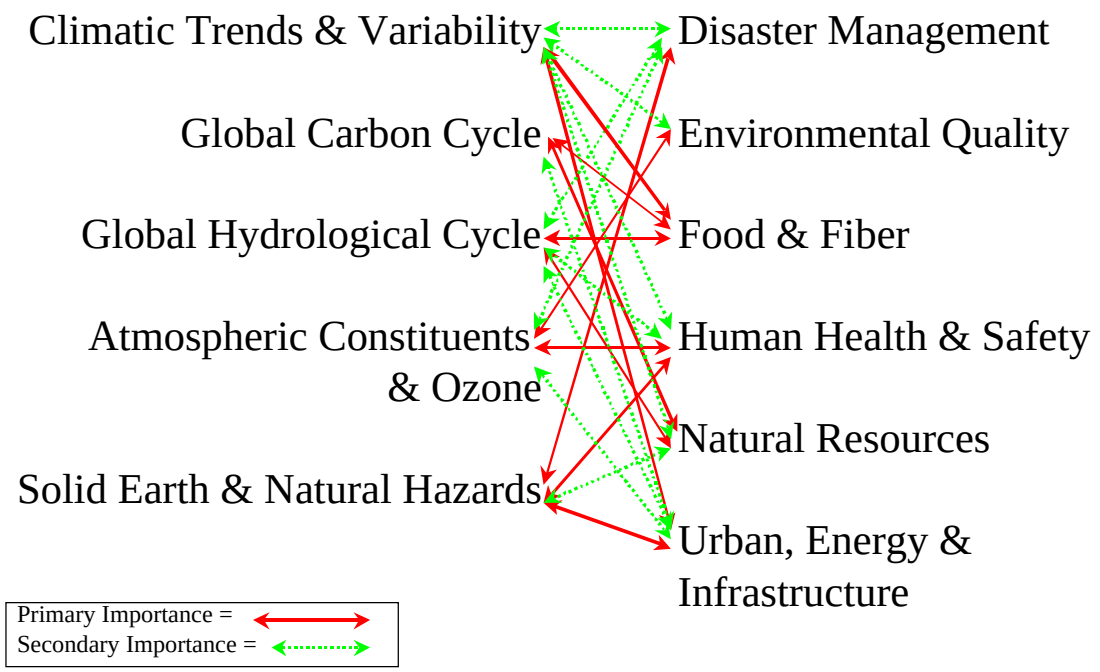
A list of the current themes that will define the near-term programmatics include Disaster Management, Environmental Quality, Food and Fiber, Human Health and Safety, Natural Resources, and Urban and Infrastructure. These themes have been selected in cooperation with the user sectors and beneficiaries of the Earth Science Enterprise.

Earth Science Enterprise Applications and Commercialization Themes

- **Food and Fiber**
  - e.g., Precision Agriculture; Pest control; Forestry; Rangelands
- **Natural Resources**
  - e.g., Land Use/Land Cover; Wetlands; Geology; Mineral/Energy Exploration and Extraction; Recreation; Water Resources; Wildlife Management; Bio-diversity and Habitat Analysis; Coastal and Ocean Systems(Fisheries, Human Impact on Marine Systems)
- **Disaster Management**
  - e.g., Earthquakes; Volcanic Eruptions and Ash Clouds; Landslides; Coastal Hazards; Wildfires; Flooding; Severe Storms; Short-term Climate Change Effects
- **Environmental Quality**
  - e.g., Air Quality; Tropospheric Ozone; Water Quality; Soils; Abandoned Mines; Brownfields; Electromagnetic Energy; Contingency Spill Events; Urban Heat Islands
- **Urban and Infrastructure**
  - e.g., Growth Management; Urban and Regional Planning; Infrastructure Planning (Transportation, Communication and Utilities)
- **Human Health and Safety**
  - e.g., Public health (Water; Air; Carcinogens (aerosols), Ozone); Vector-borne and Infectious Diseases

Earth Science Enterprise Applications themes have been mapped back to Earth Science Enterprise Science themes (see figure below). This mapping is not a simple one-to-one translation but a complex set of interconnections. The mapping further illustrates that each application issue is interdisciplinary in nature and requires input and knowledge from multiple scientific issues to be successfully defined and implemented. Nonetheless, although the level of maturity of each connection may be variable, the development of applications themes will be founded on the strongest Earth Science Enterprise science possible.

MAPPING OF EARTH SCIENCE ENTERPRISE (ESE) SCIENCE THEMES TO EARTH SCIENCE ENTERPRISE APPLICATIONS THEMES



Applied research and applications development is issue-driven and represents a continuum, or a "bridge," between Earth Science Enterprise science and the factors that drive the market adoption of applications in the user/beneficiary sectors.

APPENDIX B

GENERAL INSTRUCTIONS AND PROVISIONS

I. Instrumentation and/or Ground Equipment.

By submitting a proposal, the investigator and institution agree that NASA has the option to accept all or part of the offeror's plan to provide the instrumentation or ground support equipment required for the investigation or NASA may furnish or obtain such instrumentation or equipment from any other source as determined by the selecting official. In addition, NASA reserves the right to require use, by the selected investigator, of Government instrumentation or property that becomes available, with or without modification, that will meet the investigative objectives.

II. Tentative Selections, Phased Development, Partial Selections, and Participation with Others.

By submitting a proposal, the investigator and the organization agree that NASA has the option to make a tentative selection pending a successful feasibility or definition effort. NASA has the option to contract in phases for a proposed experiment, and to discontinue the investigative effort at the completion of any phase. The investigator should also understand that NASA may desire to select only a portion of the proposed investigation and/or that NASA may desire the individual's participation with other investigators in a joint investigation, in which case the investigator will be given the opportunity to accept or decline such partial acceptance or participation with other investigators prior to a selection. Where participation with other investigators as a team is agreed to, one of the team members will normally be designated as its team leader or contact point.

III. Selection Without Discussion.

The Government reserves the right to reject any or all proposals received in response to this AO when such action shall be considered in the best interest of the Government. Notice is also given of the possibility that any selection may be made without discussion (other than discussions conducted for the purpose of minor clarification). It is therefore emphasized that all proposals should be submitted initially on the most favorable terms that the offeror can submit.

IV. Foreign Proposals.

See NASA FAR Supplement 1872.705-1 General Instructions and Provisions Appendix B, Management Plan and Cost Plan, paragraph (a)(3).

NASA FAR Supplement 1872.705-1, General Instructions and Provisions, Appendix B, Management Plan and Cost Plan, paragraph (a)(3)

(3) Additional Guidelines Applicable to Non-U.S Proposers Only

The following guidelines are established for foreign responses to NASA's AO. Unless otherwise indicated in a specific announcement, these guidelines indicate the appropriate measures to be taken by foreign proposers, prospective foreign sponsoring agencies, and NASA leading to the selection of a proposal and execution of appropriate arrangements. They include the following:

(i) Where a "Notice of Intent" to propose is requested, prospective foreign proposers should write directly to the NASA official designated in the AO and send a copy of this letter to the International Relations Division, Office of External Relations, Code IR, NASA, Washington, DC 20546, U.S.A.

(ii) Unless otherwise indicated in the AO, proposals will be submitted in accordance with this Appendix excluding cost plans. Proposals should be typewritten and written in English.

(iii) Persons planning to submit a proposal should arrange with an appropriate foreign governmental agency for a review and endorsement of the proposed activity. Such endorsement by a foreign organization indicates that the proposal merits careful consideration by NASA and that, if the proposal is selected, sufficient funds will be available to undertake the activity envisioned.

(iv) Proposals including the requested number of copies and letters of endorsement from the foreign governmental agency must be forwarded to NASA in time to arrive before the deadline established for each AO. These documents should be sent to:

National Aeronautics and Space Administration
International Relations Division
Code IY
Office of External Relations
Washington, DC 20546
U.S.A.

(v) Those proposals received after the closing date will be treated in accordance with NASA's provisions for late proposals. Sponsoring foreign government agencies may, in exceptional situations, forward a proposal directly to the above address if review and endorsement is not possible before the announced closing date. In such cases, NASA should be advised when a decision on endorsement can be expected.

(vi) Shortly after the deadline for each AO, NASA's International Relations Division will advise the appropriate sponsoring agency which proposals have been received and when the selection process should be

completed. A copy of this acknowledgment will be provided to each proposer.

(vii) Successful and unsuccessful proposers will be contacted directly by the NASA Program Office coordinating the AO. Copies of these letters will be sent to the sponsoring Government agency.

(viii) NASA's International Relations Division will then begin making the arrangements to provide for the selectee's participation in the appropriate NASA program. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

(A) A letter of notification by NASA.
(B) An exchange of letters between NASA and the sponsoring foreign governmental agency.
(C) An agreement or Memorandum of Understanding between NASA and the sponsoring foreign governmental agency.

V. <u>Treatment of Proposal Data</u>.

It is NASA policy to use information contained in proposals and quotations for evaluation purposes only. While this policy does not require that the proposal or quotation bear a restrictive notice, offerors or quoters should place the following notice on the title page of the proposal or quotation and specify the information, subject to the notice by inserting appropriate identification, such as page numbers, in the notice. Information (data) contained in proposals and quotations will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice. To prevent inadvertent disclosure, proposal data shall not be included in submissions (e.g., final reports) that are routinely released to the public.

RESTRICTION ON USE AND DISCLOSURE OF
PROPOSAL AND QUOTATION INFORMATION (DATA)

The information (data) contained in [insert page numbers or other identification] of this proposal or quotation constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed for other than evaluation purposes; provided, however, that in the event a contract is awarded on the basis of this proposal or quotation the Government shall have the right to use and disclose this information (data) to the extent provided in the contract. This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

VI. Status of Cost Proposals (U.S. Proposals Only).

The investigator's institution agrees that the cost proposal is for proposal evaluation and selection purposes, and that following selection and during negotiations leading to a definitive contract, the institution may be required to resubmit cost information in accordance with FAR 15.403-5.

VII. Late Proposals.

The Government reserves the right to consider proposals or modifications thereof received after the date indicated should such action be in the interest of the Government.

VIII. Source of Space Transportation System Investigations.

Investigators are advised that candidate investigations for Space Transportation System (STS) missions can come from many sources.

IX. Disclosure of Proposals Outside Government.

NASA may find it necessary to obtain proposal evaluation assistance outside the Government. Where NASA determines it is necessary to disclose a proposal outside the Government for evaluation purposes, arrangements will be made with the evaluator for appropriate handling of the proposal information. Therefore, by submitting a proposal the investigator and institution agree that NASA may have the proposal evaluated outside the Government. If the investigator or institution desire to preclude NASA from using an outside evaluation, the investigator or institution should so indicate on the cover. However, notice is given that if NASA is precluded from using outside evaluation, it may be unable to consider the proposal.

X. Equal Opportunity (U.S. Proposals Only).

By submitting a proposal, the investigator and institution agree to accept the following clause in any resulting contract:

EQUAL OPPORTUNITY

During the performance of this contract, the Contractor agrees as follows:

(a) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.

(b) The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (1) employment, (2) upgrading, (3) demotion, (4) transfer, (5) recruitment or recruitment advertising, (6) layoff or termination, (7) rates of pay

or other forms of compensation, and (8) selection for training, including apprenticeship.

(c) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(d) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(e) The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding the notice to be provided by the Contracting Officer, advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(f) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(g) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. Standard Form 100 (EEO-1), or any successor form, is the prescribed form to be filed within 30 days following the award, unless filed within 12 months preceding the date of award.

(h) The Contractor shall permit access to its books, records, and accounts by the contracting agency or the Office of Federal Contract Compliance Programs (OFCCP) for the purposes of investigation to ascertain the Contractor's compliance with the applicable rules, regulations, and orders.

(i) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, the contract may be canceled, terminated, or suspended in whole or in part, and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended, the rules, regulations, and orders of the Secretary of Labor, or as otherwise provided by law.

(j) The Contractor shall include the terms and conditions of subparagraph l through 9 of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

(k) The Contractor shall take such action with respect to any subcontract or purchase order as the contracting agency may direct as means of enforcing these terms and conditions, including sanctions for non-compliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

XI. <u>Patent Rights</u>.

(a) For any contract resulting from this solicitation awarded to other than a small business firm or nonprofit organization, the clause at 1852.227-70, "New Technology," shall apply. Such contractors may, in advance of contract, request waiver of rights as set forth in the provision at 1852.227-71, "Requests for Waiver of Rights to Inventions."

(b) For any contract resulting from this solicitation awarded to a small business firm or nonprofit organization, the clause at FAR 52.227-11, "Patent Rights--Retention by the Contractor (Short Form)" (as modified by 1852.227-11), shall apply.

APPENDIX C

GUIDELINES FOR PROPOSAL PREPARATION

The following guidelines apply to the preparation of proposals in response to this University Earth System Science (UnESS) AO. The material presented is a guide for the prospective proposer, and is not intended to be all encompassing. The proposer should, however, provide information relative to those items applicable, as well as other items required by the AO. In the event of an apparent conflict between the guidelines in this Appendix and those contained within the body of the AO, those within the AO shall take precedence. Note that these guidelines apply to the original proposal that, if successful, will result in selection for the Concept Study. A separate document provides the guidelines for preparation of the Concept Study that will be used for the Downselect Process.

GENERAL GUIDELINES

All documents must be typewritten in English, use the International System (SI) of units, and be clearly legible. Submission of proposal material by facsimile (fax), electronic media, videotape, floppy disk (except as noted below), etc., is not acceptable. In evaluating proposals, NASA will only consider printed material. Although you are allowed to provide references to published papers, World Wide Web sites, etc., your proposal cannot rely upon these. The Evaluation panels are not obligated to check or refer to these references.

The proposal must consist of only one volume, with readily identified sections corresponding to sections A through L given below. Note the guidance on page count for the various sections specified in Table C-1.

In order to allow for recycling of proposals after the review process, all proposals and copies must be submitted on plain white paper only (e.g., no cardboard stock or plastic covers, no colored paper, etc.). Photographs and color figures are permitted if printed on recyclable white paper only. The original signed copy (including cover page, endorsements, and Appendix F certifications) should be bound in a manner that makes it easy to disassemble for reproduction. Except for the original, two-sided copies are preferred. Every side upon which printing appears will be counted against the page limits.

Proposals shall contain no more than 50 pages, exclusive of the investigation summary, cover page, table of contents and endorsements (see Table C-1), including no more than four fold out pages (28 x 43 cm; i.e., 11 x 17 inches). If (and only if) you are requesting the additional funding from the Office of Equal Opportunity programs, you are allowed one additional page. This must be a stand-alone page. This page will be removed for the proposal review and used only after selection for the separate review by the Office of Equal Opportunity Programs.

Table C-1. Proposal Page Count Limits

Section	Section Name	Page Limits
A	Investigation Summary	Use UnESS Forms 1 & 2
B	Cover Page	1 (not part of proposal limit)
C	Endorsements	No limit (not part of proposal limit)
D	Table of Contents	No limit (not part of proposal limit)
E	Science/Applications Investigation	25 pages total for combination of Sections E and F
F	Student Involvement Investigation Description	
G	Technical Implementation	25 pages total for combination of Sections G, H, I, and J
H	Management	
I	Cost and Cost Estimating Methodology	
J	Other Opportunities	
K	Office of Equal Opportunity Programs Minority University Research and Education Programs Funding (This additional page is allowed only for those proposals requesting funding from the Office of Equal Opportunity Programs)	1 (required to be on separate page for removal during evaluation process)
L	Appendices: (no others permitted) Resumes (one page per team member) Letters of Endorsement Certifications Statement(s) of Work (SOW) Reference List (optional) Acronyms List (optional)	No page limit, but small size encouraged

All pages other than fold out pages shall be 8.5 x 11 inches or A4 European standard. Single- or double-column format is acceptable. In complying with the page limit, no page should contain more than 55 lines of text and the type font should not be smaller than 12-point Times (i.e., approximately 15 characters per inch). Figure captions should be in 12 point. Smaller font is allowed within figures, Investigation Summary Forms, and in the cost table. Table C-1 provides guidance on page count within the proposal.

ELECTRONIC VERSION GUIDELINES

As described in Sections 4.3.2 and 4.3.3 of this Announcement, you should also provide diskettes containing electronic versions of your proposal, along with a brief description of the contents of the diskettes. All information shall be provided on DOS-compatible (version 5.0 or higher), high density (1.44 megabytes), 3-1/2" diskettes. All text portions of the proposal shall be provided in Microsoft Word for Windows format (version 6.0 or earlier) and in ASCII (DOS) format on separate diskettes.

Only the text portion plus table and figure portions need be provided on diskettes. You do not need to include material of an essentially graphic nature. Do not include information on the diskettes that is not included in the paper volume of the proposal. If the diskettes are found to include information that differs from the paper volume or are found to be defective (e.g., non-readable) the diskettes will be returned to the proposer and the proposer shall promptly provide replacement diskettes. These replacement diskettes will not be considered a late proposal under NFS 1815.412, Late Proposals, Modifications and Withdrawal of Proposals. Diskettes should be checked for computer viruses before submission.

If you find it necessary to segment the proposal on multiple diskettes either because of diskette space or other limitations, the files should be as large as possible and have a logical relationship to the proposal structure. Also provide a brief description explaining the diskette file structure, naming conventions, and other information that the proposer feels may be helpful to use these files. Include the name and version of the software used to check the diskettes for computer viruses. These pages do not count toward the proposal pages limit.

PROPOSAL CONTENT GUIDELINES

The outline and content of each proposal are described below. Only the high level table of contents given in Table C-1 is required (i.e., Sections A through L). The lower level subsection headings are advisory. Proposers should also refer to the evaluation criteria listed in Section 5 of the AO to ensure that the proposal address the factors NASA will use to evaluate the investigation.

A. INVESTIGATION SUMMARY

A summary of the proposed investigation must be included <u>with</u> the proposal. UnESS Forms I and II are to be used for this Summary and are located at the end of this Appendix C. Continuation sheets are not allowed. The Investigation Summary is not counted against the page limit.

B. COVER PAGE

A cover page must be a part of the proposal, but will not be counted against the page limit. It must be signed by the Principal Investigator and an official by title of the

investigator's organization that is authorized to commit the organization. The full names of the Principal Investigator and the authorizing official, their addresses with zip code, telephone and fax numbers, and electronic mail addresses, shall be included. If the proposal includes a request for funding from the Office of Equal Opportunity Programs for Historically Black Colleges and Universities and Other Minority Universities (HBCU/OMU) capacity augmentation as described in Sections 5.1.1 and 5.2.7 of this Announcement and in Section K below, then the cover page must in addition, be signed by an official by title of the HBCU/OMU that is authorized to commit the organization.

C. ENDORSEMENTS

All co-investigators, lead team members and non-U.S. endorsements must be included as part of the proposal. These pages will not be counted against the page limit. Endorsements shall include the signature, full name, address with zip code, telephone and fax numbers, and electronic mail address.

Participation by non-U.S. individuals and/or institutions as team members or contributors to UnESS investigations must be endorsed by the institutions and/or governments involved. Institutional endorsement is required for contributions. If government support is required then a government endorsement is also needed. The letter of endorsement must provide evidence that the non-U.S. institution and/or government officials are aware and supportive of the proposed investigation and will pursue funding for the investigation if selected by NASA. Such endorsements must be submitted per the schedule in Section 1.3 and in compliance with the provisions of Sections 3.1 and 4.3.1. Include these letters in the Appendix, as indicated below.

D. TABLE OF CONTENTS

The proposal should contain a table of contents, which will not be counted against the page limit. This table of contents should parallel the outlines provided below in Sections E through L.

E. SCIENCE/APPLICATIONS INVESTIGATION

1. Science/Applications Goals, Objectives, and Justification

This section should consist of a discussion of the goals and objectives of the investigation, their value to the primary and any secondary science/applications themes and questions (see Appendix A), and their relationships to past, current, and future investigations and missions. It should describe the history and basis for the proposal and discuss the need for such an investigation. This should include the explicit justification of the investigation to the Earth science/applications question.

The scientific/applications merit of the proposed investigation can be intrinsic to the mission itself, or based on the value of the technology to future

science/applications demonstrated through the mission. This includes innovative technology for new Earth system data sets and innovative technology to better measure current Earth system data sets. For example, if the scientific goal depends upon deployment of a larger mission or a fleet of small spacecraft, the UnESS mission could be a demonstration of a key instrument or a single element of that fleet. In this case, NASA will assess the likelihood that the proposed flight demonstration will lead to a successful full mission. Plans and/or technology insertion roadmaps for transferring such technologies to other missions, and/or to the private sector, including the non-aerospace sector are encouraged. The means by which NASA's Office of Earth Science plans to implement new technology is described in the *Office of Earth Science Integrated Technology Strategy* (http://www.earth.nasa.gov/visions/index.html) *and the NASA Technology Plan* (http://technologyplan.nasa.gov/).

2. Measurement Objectives and the Nature of the Investigation

   Proposals must cover the end-to-end investigation to answer the over-arching Earth system scientific/applications questions. The relationship between the proposed scientific objectives, the data to be returned, and the instrument payload to be used in carrying out the proposed investigation must be unambiguous and clearly stated in the proposal. Any support activities including balloon, aircraft, and ground validation/calibration activities must be described.

   Your proposal should demonstrate that your mission will acquire the necessary results within the life-span of the mission. Your mission should not require an extension of the mission beyond the life proposed and costed in you proposal. Extended missions will not be considered as part of this AO.

   Included also a discussion of any descope or reduced mission performance options. Discuss the impacts of these and the scientific/application resilience of the investigation.

3. Instrumentation

   This section should describe the instrumentation and the criteria used for its selection. It should identify the individual instruments and instrument systems, including their characteristics and requirements for number of channels, mass, power and volume. A science traceability analysis should be preformed mapping between the science/application objectives, the measurements, the functional requirements, and the engineering requirements. Such characteristics include a discussion of the data rates, fields of view, resolution, precision/sensitivity, pointing accuracy, calibration, etc

4. Anticipated Science/Applications Return

   The relationship between the data products generated and the scientific/applications objectives should be explicitly described, as should the

expected results. UnESS mission teams will be responsible for the measurements to be taken in the course of the mission, the data to be returned, the approach that will be taken in analyzing the data to achieve the scientific objectives of the investigation, the initial analysis of the data, its subsequent delivery to an appropriate data repository, the publication of scientific findings, and communication of results to the science community and public. You should provide a discussion of the scientific products and how the science/applications products and data obtained will be used to fulfill the scientific objectives. This should include a discussion of how the science/applications data will be obtained, including a plan for delivery of the products, and the individuals responsible for the data delivery. This description should identify the investigation to be performed, the quality of the data to be returned (resolution, coverage, pointing accuracy, measurement precision, etc.), and the quantity of data to be returned (bits, images, etc.).

The plan for algorithm development should be discussed. In addition, the data reduction and analysis plan, after the data have been delivered to the ground, should be discussed, including the method and format of the data reduction, data calibration and validation, and preliminary analysis. The process by which data will be prepared for archiving and distribution should be discussed, including a list of the specific data products and the individual team members responsible for the data products. The plan must include a detailed schedule for the submission of raw and reduced data to the appropriate data archive in the proper formats, media, etc. Delivery of the data to the data archive must take place in the shortest time possible.

In accordance with NASA policy, data from NASA funded missions must be disseminated to the scientific community without restriction for a cost of no more than the cost of dissemination. UnESS teams are encouraged to propose innovative data management processes for data dissemination and wide data distribution processes. For data from a mission with significant U.S. private sector investment, innovative data management approaches will be considered. Data are to be released as soon as possible after a brief data validation period appropriate for the mission and the process must be described. UnESS teams will be responsible for collecting the scientific, engineering, and ancillary information necessary to validate and calibrate the scientific data prior to depositing it in the appropriate data repository. This repository can be a database accessible by the scientific community through the Internet or may conform to the Office of Earth Science Data and Information Policy Guidelines (MTPE/EOS Reference Handbook, Asrar and Greenstone, 1995). The time required to complete this process should be the minimum necessary to provide appropriate data to the scientific community and the general public and must be described in the proposal. As part of the funded data analysis, archival and dissemination activities, mission teams must include an appropriate period for data analysis independent of archiving activities.

5. Science/Applications Team

   This section must identify the mission science team and their roles and responsibilities. The capabilities and experience of all members of the proposed science team should be described. For any student members of the science team that may lack previous experience your proposal should demonstrate other considerations, such as the relationship to and experience of the student's mentor for the mission. Resumes or curriculum vitae of team members and/or mentors should be included as attachments to the proposal (see Section L, below). The role of each science team member in the investigation should be explicitly defined and justified.

6. Plans to Resolve Open Science/Applications Investigation Issues

   Identify and discuss any unresolved issues. Included your planned approach and schedule for resolving these issues.

F. STUDENT INVOLVEMENT INVESTIGATION DESCRIPTION

For this UnESS AO, a student is defined as any individual enrolled in an accredited university educational program with the documented intention of obtaining a degree.

1. Student Involvement Goals and Objectives

   This AO is intended to foster the development of the next generation of Earth system scientists, engineers, managers, educators, and entrepreneurs through student involvement in Earth observation space missions at the university level. The student involvement section should describe the significant and meaningful <u>hands-on</u> student involvement objectives of the proposed investigation.

   This section should consist of a discussion of the goals and objectives of the student involvement aspects of the investigation, the criteria used to determine these goals and objectives, and the value of the investigation to the education of students.

2. Extent and Breadth of Student Involvement

   Hands-on student involvement should occur through the complete mission process from proposal development through analysis and distribution of the data to the science community.

   NASA expects that the nature of the UnESS AO implies that university scientific and engineering students will be involved in the entire process. However, NASA uses the expertise of many disciplines in addition to the science and engineering disciplines in the management and communications of its projects. In today’s environment, the government must learn to use the “best practices” of business, and NASA needs to know of and use all the talents available to produce the best

value for the taxpayers. Therefore, it is strongly recommended that the missions be expanded to non-science/engineering university schools such as business, journalism and communications, graphic and fine art, education, law and etc. These and other disciplines can produce products that are important to the overall success of a mission and the communication of its results. It also provides a larger opportunity for expanding the base of citizens that understand the importance of NASA's research in disciplines that normally do not have contact with NASA and its programs. Some examples of how this may work are given below.

- Extremely low-cost missions of this type require innovative management practices. A business school can be associated with the team to develop innovative management practices and procedures and then support the actual management of the mission.
- A journalism and communications school can develop a communications campaign for a mission and provide this service to the mission, NASA and the Earth Science Enterprise.
- A graphic and fine art school can develop public relations and communications campaign visual products for the mission, NASA, and the Earth science/applications program.
- An education school can develop and implement techniques to educate the next generation of university students and projects to inform the public about a mission and the importance of it to the overall Earth science/applications program.

This section should also describe any plans for participation by minority students and/or by Historically Black and Colleges and Universities and Other Minority Universities. NASA strongly encourages you to consider participation of HBCU/OMU and under represented students in general in your UnESS proposal. REMINDER: You must include in the main body of your proposal all relevant information on minority student and minority university involvement. The Office of Equal Opportunity Programs Minority University Research and Education Funding section of your proposal (see K below) will be removed and evaluated separately, only for those proposals selected for Concept Study Report funding.

3. Educational and Academic Impact of Student Involvement

   This section should describe the plan for integrating all the student involvement aspects of this AO into the complete mission process, including proposal development through deliver of data to the science/applications community, and education and public outreach.

4. Mentoring and Student Oversight

   This section should describe the relationship between the students involved in the mission and their mentors. Include in this section your plans and processes for

monitoring and reviewing the student's work and progress towards mission completion.

5. Plans to Resolve Open Student Involvement Issues

   Identify and discuss any unresolved issues. Include your planned approach and schedule for resolving these issues.

G. TECHNICAL IMPLEMENTATION

The Technical Implementation section should describe the method and procedures for investigation definition, design, development, integration, ground operations, and flight operations. A discussion of all new technologies to be used for the investigation, including back-up plans with scheduled decision criterion for those technologies, should be provided. This section should also detail the expected products and end items associated with each phase. Mission teams have the freedom to use their own processes, procedures, and methods. The use of innovative processes, techniques, and activities by mission teams in accomplishing their objectives is encouraged when cost, schedule, and technical improvements can be demonstrated. The benefits of such processes and products should be discussed.

1. Mission Design

   This section should provide an overview of the mission, including mission design, mission design drivers, instrument accommodation, spacecraft, launch vehicle and services required, orbital parameters, ground systems communications approach, and mission operations plan

   Specific information should be included that describes the unique requirements placed on these mission elements by the science/applications investigation. Proposals should include linkage between required physical measurement and proposed mission approach. Consider providing a "traceability matrix" showing how the proposed mission design complies with the stated objectives, requirements, and constraints of the proposed investigation.

   The proposal should describe the mission observing strategy and spacecraft performance required for obtaining the necessary data with the proposed instrumentation. Include the concept for operating the mission and the requirements for mission operations. Consider providing a preliminary mission timeline indicating periods of data acquisition, data downlink, etc. Include the rationale for the selection of launch option.

   Address in your proposal the heritage and maturity of mission elements including, the spacecraft, ground systems, and mission design. The proposal should describe the systems engineering approach including the integration and test approach, trade studies to be conducted, and the approach to flight assurance, including

reliability and redundancy. Identify and discuss any innovative features of the mission design that minimize total mission costs.

2. Instrument Implementation

   This section should describe the science applications instrument (or instruments) for the investigation. Include a preliminary description of each instrument with a block diagram showing the instrument systems and their interfaces, along with a description of the estimated performance of the instrument. Provide a summary of the key margins, including the rationale for margin allocation. Identify those design margins that are driving costs.

   Your proposal should indicate items that are proposed to be developed, as well as any existing instrumentation or design/flight heritage. Consider including an Instrumentation Technical Maturity Matrix showing the technical maturity of the instrument components, using the technical readiness levels (defined in Appendix G). Discuss the steps needed for space qualification of your instrument. Identify any innovative features incorporated to effect cost savings. Include where appropriate calibration plans and operational/control considerations.

3. Instrument Interface and Payload Integration

   This section should include information pertinent to the accommodation of the instrumentation on the spacecraft (or host platform if proposal is for a partial mission). Describe the Instrument characteristics and requirements, and how they match the capabilities of the spacecraft, such as:

   - mass
   - volumetric envelope
   - attitude
   - fields of view
   - weight
   - power
   - thermal
   - pointing
   - stability
   - command and telemetry

   Discuss the sensitivity to or generation of contamination (e.g., electromagnetic interference, gaseous effluents, etc.), and the potential (if any) for significant instrument-generated jitter and momentum. Describe the planned process for physically and analytically integrating the instrument(s) with the flight system. Describe the testing strategy of the science/applications payload, prior to integration with the spacecraft.

4. Spacecraft

   This section should describe the spacecraft design approach, particularly as it relates to new versus existing hardware. It should identify the spacecraft systems and describe their characteristics and requirements. The proposal should include a description of the flight system design with a block diagram showing the flight element subsystems and their interfaces, along with the approach for development of the flight software. Describe the flight heritage or rationale used to select the flight system and its subsystems, major assemblies, and interfaces. The discussion of heritage should address two important issues: (1) prior flight experience or flight-qualified design of specific subsystem components, and; (2) overall subsystem design, whether new, modified, or exact repeat of a design flown previously. This section should also discuss the design process used: trade studies, simulations, technology development, engineering models, prototypes, etc.

   Subsystem characteristics and requirements should be described to the greatest extent possible. Any design features incorporated to effect cost savings should be identified; however, benefits should be specified and enabling assumptions or risks should be identified. Provide the rationale for, and derivation of, margin allocations including mass, power, communication link, pointing accuracy, etc. Identify those design margins that are driving costs.

   For partial mission proposals, provide the appropriate information above that is related to the proposed investigation's requirements on and interfaces with the host spacecraft.

5. Launch Service

   Describe your launch option selection. Since the relatively low cost cap for UnESS mission precludes a dedicated launch, your proposal should discuss the range of acceptable launch options, orbit parameters, and the likelihood that your mission will be able to find a ride in the timeframe you are proposing. If you are proposing a partial mission (that is, and instrument on another, host spacecraft), describe the plans for the host mission. Include information on the launch option margins and reserves (volume, mass, etc.).

6. Manufacturing, Integration and Test

   This section should describe the manufacturing strategy to produce, test, and verify the hardware/software necessary to accomplish the mission. It should include a description of the main processes/procedures planned in the fabrication of flight hardware, software, production personnel resources, incorporation of new technology/materials, and the preliminary test and verification program. A preliminary schedule for manufacturing, integration, and test activities should be included. A description of the planned end items, including engineering and qualification hardware, should be included.

7. Mission Operations, Ground and Data System

This section should discuss mission operations and the ground operations support required for the proposed investigation. The planned approach for managing mission operations and all flight operations support, including mission planning, should be discussed. The approach to the development of the ground data system, including the use, if any, of existing facilities, including Government facilities, should be described. Consider including a block diagram of the Ground Data System (GDS) showing the end-to-end concept (acquisition through archiving) for operations and data flow to the subsystem level. Describe communications, tracking, and ground support requirements. Describe the software design heritage and software development approach and its relationship to the flight system software development. Discuss the proposed communications (or active sensing) frequency bands, and identify any issues for obtaining spectrum allocation license(s). Provide estimates of the following:

<u>Downlink Information.</u>

- Data volume (Mbytes/day),
- Bit error rate,
- Onboard storage (Mbytes),
- Power available for communications (watts),
- Number of data dumps per day,
- Housekeeping data destination (latitude and longitude),
- Science/applications data destination (latitude and longitude), and
- Maximum time lag between data dump and data arrival at destination.

<u>Uplink Information.</u>

- Number of uplinks per day,
- Number of Bytes per uplink,
- Bit error rate.

Specific features incorporated into the flight and ground system design that lead to low-cost operation should be identified. The use of any existing mission operations facilities and processes should be described, as well as any new facilities required to meet mission objectives.

Mission teams may use non-NASA or NASA navigation, tracking, control, communications, and other services. Information on space communications capabilities and costing is given in the Ground Data Systems and Mission Operations and Data Analysis document available in the UnESS Project Library. ISS payloads must use the ISS communications systems which are provided at no cost and described in documents referenced in the ISS UnESS Research Opportunities document in the UnESS Project Library.

8. Plans to Resolve Open Technical Implementation Issues

This section should describe the means by which the mission definition and preliminary design study will be performed. This section should identify the key mission tradeoffs and options to be investigated during the Concept Definition Studies and should identify those issues, technologies, and decision points critical to the mission success. Identify and discuss any unresolved issues and potential risk areas to the proposed investigation. Identify your approach and schedule for resolving these issues and mitigating these risks. For example:

- NASA recognizes that teaming arrangements to implement the investigation may not be complete at the time of the proposal. If your teaming arrangements are not complete, demonstrate in your proposal that there are multiple candidate implementation approaches for the spacecraft, launch vehicle, communications, and ground systems that will allow the successful implementation of the investigation.
- NASA seeks innovative missions but because of the short definition and development time, significant technology development may not be possible although technology infusion that enhances performance and reduces costs of the mission is encouraged. Investigations dependent on new technology, technology development, or technology enhancement must identify the technology(s) along with risks involved and alternative approaches to resolve issues by completion of the Concept Study. If necessary, identify a reasonable back-up approach that will assure the success of the investigation.

H. MANAGEMENT

A single Principal Investigator (PI) that will be responsible for the scientific integrity of the mission must lead each UnESS mission investigation team. Co-Investigators may be from any category of U.S. or non-U.S. organization, including educational institutions; industry or nonprofit institutions; one of the NASA Centers, the Jet Propulsion Laboratory (JPL), other Federally-funded research and development centers, or other U. S. Government agencies; or foreign organizations. However, Co-Investigators must have an identified role in the proposal, play a defined and necessary role in the investigation, and covered in the funding plan. Teams may be formed from any combination of these institutions but must facilitate significant and meaningful hands-on participation by U.S. university students. Industry mentorships of missions are encouraged if industry brings significant contributions to the mission. This mission team has full responsibility and authority to accomplish the mission.

The PI is expected to be in charge of the proposed investigation, with full responsibility for its scientific integrity. The PI is responsible for assembling a team to propose and implement the investigation. Proposers may obtain services from any source. Please note that the level of detail required in the proposal is the same, independent of which organizations are part of the proposed mission team. The PI is accountable to NASA for the scientific success of the investigation. Therefore, the PI

must be prepared to recommend mission termination if, in his/her judgment, the successful achievement of established science/applications objectives, as defined in the proposal, is no longer likely within the committed cost and schedule reserves.

Each selected investigation must have a Project Manager (PM) who reports to the PI and will oversee the technical implementation of the investigation. The role, qualifications, and experience of the PM should be adequate to ensure that the technical and managerial needs of the investigation will be met. The PI or a student is not precluded from assuming the role of PM provided that he/she meets the above criteria and has sufficient time to fulfill all proposed roles.

1. Management Processes and Plans

   This section should briefly summarize the investigator's proposed management approach, tools and processes. Proposals must encompass all aspects of the investigation from the initial studies through delivery of the data to the appropriate data repository and their analysis. NASA Handbook NPG 7120.5A, *Management of Major System Programs and Requirements*, delineates activities, milestones, and products typically associated with each of the phases and may be used as a reference in defining a team's mission approach. This Handbook is included in the UnESS Project Library (see Appendix D). Mission teams have the freedom to use their own processes, procedures, and methods, and the use of innovative processes is encouraged when cost, schedule, technical improvements, and reliability can be demonstrated.

   Partial mission proposals should specifically address how the mission team will interrelate with the host organization, organizationally and managerially. Partial mission proposals should also address the following:

   - Describe the status of the commitment from the spacecraft builder/owner or sponsoring organization to fly the proposed instrument or conduct the proposed investigation.
   - Describe if and how the proposed investigation relates to the spacecraft sponsor's overall mission objectives.
   - Describe the investigation development plan and how it fits in the development plan for the sponsor's mission.
   - Describe how the operations plan for the proposed investigation fits within the mission of the sponsoring organization.

   The team must propose performance metrics that will be incorporated into a successful team's contract. Violation of the agreed upon metrics may be cause for termination. The mission team should develop a Work Breakdown Structure (WBS) that best fits its organizational approach and mission design concept. Successful innovative management approaches will be examined by Office of Earth Science for use within the Earth science/applications program.

NASA will exert limited oversight of the selected missions and intends to allow the Principal Investigator and his/her team to use their own management processes, procedures, and methods to the fullest extent possible. Mission teams should define the management, review and reporting approach and management tools for tracking cost, schedule and risk best suited for their particular teaming arrangement. Each team must have a safety reliability and quality assurance program. These approaches should be commensurate with the investigation's implementation approach, while retaining a simple and effective management structure necessary to assure the adequate control of development within the cost and schedule constraints. NASA only will require four reviews.

- Preliminary Design Review during mission definition phase
- Mission Confirmation Review during mission definition phase
- Mission Readiness Review
- Launch Readiness Review

Additional Shuttle and ISS required safety reviews are described in the ISS UnESS Research Opportunities document in the UnESS Project Library.

The use of innovative processes, techniques, and activities by mission teams in accomplishing their objectives is encouraged; however, they should be employed only when cost, schedule, or technical improvements can be demonstrated and specific enabling assumptions are identified. In addition, each team should identify management processes and tools that may be useful to NASA in the management of its programs and projects.

2. Schedule

A project schedule to meet the proposed launch date and covering all phases of the investigation should be provided. The schedule should include, as a minimum, proposed major project review dates including NASA required reviews; instrument development; spacecraft development; instrument-to-spacecraft integration and test; launch vehicle integration; and mission operations and data analysis. Schedule reserve should be clearly identified.

3. Team Organization, Structure, and Experience

The proposal should describe and discuss the management organization and decision-making process and the teaming arrangement. This should include the responsibilities of team members, including contributors, and institutional commitments. The proposal should address any unique capabilities that each team member organization brings to the team, as well as previous experience with similar systems and equipment. The specific roles and responsibilities of the Principal Investigator, Co-Investigators, and Project Manager who should report to the Principal Investigator should be discussed. Key project personnel (*e.g.,* the Project Manager) need not be identified by name at this time.

4. Risk Management

Each investigation must define the risk management approach it intends to use to ensure a safe and successful achievement of the mission objectives within established resource and schedule constraints. Included in this discussion of risk management should be risk mitigation plans for any new technologies and the need for any long-lead items that need to be placed on a contract before the start of the development phase, to ensure timely delivery. In addition, any manufacturing, test, or other facilities needed to ensure successful completion of the proposed investigation should be identified.

5. Mission Assurance and Safety

This section should describe the proposed approach to ensure product quality, including identification of trade studies, the parts selection strategy, and the plans to incorporate new technology. This section should also describe the product assurance plan, including plans for problem/failure reporting, inspections, quality control, parts selection and control, reliability, safety assurance, and software validation. Selected investigations shall have a product assurance program that is consistent with the ISO 9000 series, American National Standard, "Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation, and Servicing," ANSI/ASQC Q9001-1994.

6. Facilities and Equipment

Discuss the facilities and equipment needed for the investigation, including any new, or modifications to existing, facilities, laboratory equipment, and ground support equipment (GSE) (including those of the team's proposed contractors and those of NASA and other U.S. Government agencies) required to execute the investigation. The outline of new facilities and equipment should also indicate the lead-time involved and the planned schedule for construction, modification, and/or acquisition of the facilities.

7. Plans to Resolve Open Management Issues

Identify and discuss any unresolved issues. Include your planned approach and schedule for resolving these issues.

I. COST AND COST ESTIMATING METHODOLOGY

1. Basis of Cost Estimate

The proposals must include the Total Mission Cost, which includes the NASA Earth Science Enterprise cost and all contributed costs, except for the funding provided by the Office of Equal Opportunity (this funding should be identified and discussed in Section K). The Total Mission Cost includes but is not limited to the following:

- Mission conceptual study, definition and development of all flight and ground hardware and software, acquisition of launch services, launch, and operations of the mission
- Non-satellite measurements necessary for calibration or validation of observations
- Other mission support
- Development, operation, refinement, maintenance, documentation, and publication of all required algorithms to accomplish the mission
- Processing, archiving, distribution, maintenance, documentation, and information management of all mission derived data products to permit community-wide access
- Publication of results in refereed science literature
- Delivery to NASA, at mission end, all data supporting information and available results
- Cost of the student involvement requirements, education/public outreach cost, fee and contributions.

These costs shall be consistent with the project requirements described in Sections 3, 4, and 5 of the AO. The amount to be costed in each fiscal year should be identified by providing the data in Table C-1 for University Earth System Science Missions, which will not be counted against the page limit. The top portion of Table C-1 requests cost data relative to the NASA ESE Cost. The lower portion addresses contributions. Table C-2 gives the NASA inflation index to be used to calculate real year dollars.

Identify and justify the methodology used to estimate the cost, for example, specific cost model, past performance, cost estimating relationships from analogous missions, and assumptions. Describe the budget reserve strategy, including budget reserve levels as a function of mission phase.

a. Full Cost Accounting

NASA services, facilities, and equipment can be proposed. Where NASA-provided services, facilities and equipment are used, NASA Civil Service labors and supporting NASA Center infrastructure must be costed on a full cost accounting basis. If NASA guidance for full cost accounting has not been fully developed by the closing date for proposal submission or for completion of the concept study, NASA Centers may submit full cost proposals based on the instructions in the NASA Financial Management Manual, Section 9091-5, “Cost Principles for Reimbursable Agreements,” or based on their own Center-approved full cost accounting models. Other Federal Government elements of proposals must follow their agency cost accounting standards for full cost. If no standards are in effect, the proposers must then follow the Managerial Cost Accounting Standards for the Federal Government as recommended by the Federal Accounting Standards Advisory Board.

b. NASA ESE Cost

The NASA ESE Cost is the funding that the NASA Earth Science Enterprise would be expected to provide to the mission team over the course of the investigation, beginning with initial selection and ending with the conclusion of data analysis and distribution of data to the scientific community. Examples of costs to be included are any upper stages; flight hardware, including science/applications instrumentation and spacecraft; launch services; education and outreach activities; new technology; subcontracting costs (including fees); science/applications teams; all personnel required to conduct the investigation, analyze and publish results, and deliver data in archival format; insurance; ground data system; labor (contractor); NASA Civil Servant costs; reserves; and contract fees. A mission reserve will not be maintained by Office of Earth Science; therefore, each mission must include its own credible mission phased reserve proportional to the development risk. The NASA Earth Science Enterprise costs for the mission is capped at $15 M including launch services and proposers are strongly encouraged to propose lower cost missions. This is a cap in funding, not a guide, and those proposals that are proposed at the cap will not be able to adjust during the Concept Study. The cost is a consideration in the selection of investigations and in the continuing assessment of ongoing missions.

c. Goods and/or Services Offered on a No-Exchange-of-NASA-Funds Basis

Contributions of any kind, whether cash or non-cash (cash, property and/or services) to UnESS investigation by organizations other than the Office of Earth Science are encouraged but not required. Values for all contributions of property and services shall be established in accordance with applicable cost principles. Such contributions may be applied to any part or parts of a mission. A letter of endorsement that contains a statement of financial commitment from each responsible organization offering to make a contribution to the investigation must be submitted with the proposals for all U.S. components. For non-U.S. components of proposals, see Section 3.12.

The cost of contributed hardware or software should be estimated as either: (1) the cost associated with the development and production of the item if this is the first time the item has been developed and if the mission represents the primary application for which the item was developed; or (2) the cost associated with the reproduction and modification of the item (i.e., any recurring and mission-unique costs) if this is not a first-time development. If an item is being developed primarily for an application other than the one in which it will be used in the proposed investigation, then it may be considered as falling into the second category (with the estimated cost calculated as that associated with the reproduction and

modification alone). In this case, document the commitment to complete the development on the part of the organization funding the other application.

The cost of contributed labor and services should be consistent with rates paid for similar work in the offeror's organization. The cost of contributions should not include funding spent before the start of the investigation. The value of materials and supplies shall be reasonable and shall not exceed the fair market value of the property at the time of the contribution. NASA will evaluate the realism of all costs regardless of the proposed source.

2. Reserves and Margins

Include a discussion of reserves, margins, and descope options, including the time phasing and critical decision points. Justify the level and allocation of these reserves, margins and descope options based on the level of technical and programmatic risk for your investigation. Discuss the management of the reserves and margins, including whom in the management organization manages the reserves and when and how the reserves are released.

3. Plans to Resolve Open Cost Issues

Identify and discuss any unresolved issues. Include your planned approach and schedule for resolving these issues.

J. OTHER OPPORTUNITIES

The education and public outreach plans, small disadvantaged business plan, and plans for commercialization should provide a summary of the benefits offered by the mission beyond the scientific/applications and student involvement benefits brought by obtaining and analyzing the desired scientific data.

1. Educational and Public Outreach

This section shall provide a summary of the education and public outreach benefits offered by the mission beyond the scientific/applications and student involvement participation benefits (as described in Section E above). This section should reflect the proposer’s commitment to achieving the goals of the Office of Earth Science education and public outreach programs. The proposer should include innovative approaches to enhancing the level of Earth science/applications understanding and public awareness. The educational outreach discussion should discuss any proposed K-16 education activities to be preformed by the mission and should include education outreach to under represented students, including students and faculty at Historically Black Colleges and Universities and Other Minority Universities. For example, this section could describe any mentorship programs that are established with local high schools.

The goals and objectives of this aspect of the investigation and the value of a mentorship program to the education of students should be described.

Further information on the Office of Earth Science's broad approach to education and outreach can be found in *Earth Science Enterprise Educational Strategy Plan* (http://www.earth.nasa.gov/education/ edstratplan/index.html). Guidance on the use of new technology in investigations can be found at http://www.earth.nasa.gov/visions/index.html. The NASA Implementation Plan for education (http://education.nasa.gov/implan/exec.html) provides further high-level guidance.

Education programs should support the national standards in science, mathematics, technology and geography. Proposed activities might also include public information programs that will inform the public through mass media or other means, or utilize other innovative ideas for bringing Earth science/applications to the public. Proposals should include the Principal Investigator's approach for planning an education and public outreach program, arranging for appropriate partners and alliances, implementing the education and public outreach program (including appropriate evaluation activities), and plans for disseminating education and public outreach products and materials. Examples of education and public outreach activities are given in the UnESS Library.

2. Small, Small Disadvantaged, and Minority Institution Involvement

This section shall provide a summary for the subcontracting plans for Small Disadvantaged and Women-Owned Small Businesses, and Minority Institutions involvement in the implementation of the investigation. The subcontracting approach should be discussed and must state subcontracting goals for small disadvantaged, women-owned, Historically Black Colleges and Universities, and Other Minority Universities.

The proposing institution(s) shall agree to use their best efforts to assist NASA in achieving its goal for the participation of small disadvantaged businesses, women-owned small businesses, Historically Black Colleges and Universities (HBCUs), and Other Minority Universities (OMUs) including Hispanic serving institutions and Tribal colleges and Universities in NASA procurements. Investment in these organizations reflects NASA's commitment to increase the participation of minority concerns in the aerospace community and is viewed as an investment in our Nation's future. Proposals should recognize this requirement and should discuss the intent to include small disadvantaged businesses and minority institutions; however, it may not be possible to finalize plans to meet this requirement until the concept studies are complete.

NASA contracts resulting from this solicitation which offer subcontracting possibilities, exceed $500,000, and are with entities other than small business concerns, will contain the clause at FAR 52.219-9. Offerors who are selected

under the Downselect Process under this AO, and who meet the foregoing conditions, will be required to negotiate appropriate subcontracting plans. A proposed subcontracting plan shall be provided in this section and will be evaluated as part of the Downselect Process (see Section 5.1).

The institutions eligible to be considered as Minority Institutions for the purposes described in this section and in Section K below are Historically Black Colleges and Universities and Other Minority Universities as defined and certified by the Department of Education. A list of U.S. accredited post secondary minority institutions can be found at the Internet address http://www.ed.gov/offices/OCR/99minin.html.

3. Commercial Opportunities

U.S. economic and technical competitiveness achieved through partnerships between pubic sector programs and the private sector are important to the U.S. Also, many social benefits are derived from a strong U.S. economy. Therefore, proposals to enhance commercialization opportunities are encouraged. Discuss in this section the social benefits and enhanced U.S. economic and technical competitiveness achieved through partnerships between the public sector programs and the private sector. Specify any specific examples of commercialization.

4. Plans to Resolve Open Other Opportunity Issues

Identify and discuss any unresolved issues. Included your planned approach and schedule for resolving these issues.

K. OFFICE OF EQUAL OPPORTUNITY PROGRAMS MINORITY UNIVERSITY RESEARCH AND EDUCATION PROGRAMS FUNDING

Note: Include this one page section only if you are requesting funding from the Office of Equal Opportunity Programs. This section will be evaluated as a separate proposal to the Office of Equal Opportunity Programs, and will be removed prior to evaluation of your proposal by the Office of Earth Science. Therefore the main body of your proposal should describe the involvement of all mission team members, including any Historically Black Colleges and Universities and Other Minority Universities (HBCU/OMU) involvement.

After concept study selection, the Office of Equal Opportunity Programs will conduct an independent and separate evaluation of the selected proposals for significant and meaningful participation by HBCUs/OMUs for additional direct funding to the HBCUs/OMUs. The Office of Equal Opportunity Programs evaluation will not influence the concept study selections.

As a means of promoting the participation of HBCUs and OMUs in Earth science/applications and space flight missions, the Office of Equal Opportunity

Programs will consider providing additional funds. These funds will be allocated to augment the capacity of HBCUs and OMUs to participate in Earth science/applications missions. Examples of augmented capacity for HBCUs/OMUs are given in the UnESS Library. Up to $500,000 is available to be awarded by Office of Equal Opportunity Programs for significant and meaningful participation by certified HBCUs/OMUs. A maximum of $100,000 of additional one-time funds will be awarded separately from the maximum $300,000 award for each concept study selected. Any funds awarded under this program to HBCUs or OMUs may not be applied directly to the performance of the concept studies. The funds will be provided directly to the HBCUs/OMUs and can only be used by the HBCUs/OMUs. Office of Equal Opportunity Programs has the authority to make no awards if the proposals do not meet their criteria or may make multiple awards. Proposals shall include estimates of needed funds and descriptions of how the funds will be used to enhance HBCUs/OMUs current and future capacities to compete in Earth science/applications programs. Funding details should be at a level to allow evaluators to determine the appropriateness of the request.

If the proposal includes the participation of HBCUs/OMUs, this section should summarize the significant and meaningful participation of the HBCUs/OMUs. The proposal should discuss the ways in which the HBCU/OMU contributions are integral to the mission and are based on the demonstrated expertise and experience of the HBCUs/OMUs involved. Identify how this funding will be used to augment the capacities of these institutions to participate in Earth science/applications missions. The funding request shall be reported in this section and not included in the proposal cost section.

The institutions eligible to be considered as HBCUs/OMUs for the purposes described in this proposal are Historically Black Colleges and Universities and Other Minority Universities as defined and certified by the Department of Education. A list of U.S. accredited post secondary minority institutions can be found at the Internet address http://www.ed.gov/offices/OCR/99minin.html

L. APPENDICES

The following additional information is required to be supplied with the proposal as Appendices and, as such, will not be counted within the specified page limit.

1. Resumes. Provide resumes or curriculum vitae for all named team members identified in the proposal. Resumes or curriculum vitae should be no longer than one page in length.

2. Letters of Endorsement. Letters of endorsement must be provided from all organizations offering goods and/or services on a no-exchange-of-NASA-funds basis, non-U.S. organizations providing hardware or software to the investigation, Historically Black Colleges and Universities and Other Minority Universities for which Office of Equal Opportunity Funding is proposed, the major participants in the proposal, and the Launch Service provider, if the launch service is not

provided through a NASA contract. Letters of endorsement should be signed by institutional and Government officials authorized to commit their organizations to participation in the proposed investigation.

3. Statement of Work (SOW) and Funding Information: For investigations managed from non-Government institutions, provide a SOW. For investigations managed from Government institutions, provide a SOW as if the institution were non-Government. This SOW must include the requirement for a concept study report that is described in the Guidelines for UnESS Concept Study Report available through the UnESS Project Library. The SOW must include general task statements for Phases Mission Definition and Design, Mission Detailed Design, Mission Development and Launch, and Mission Operations and Data Analysis, Archival and Dissemination for UnESS Investigations, and performance metrics. All SOWs should include the following, as a minimum: Scope of Work, Deliverables (including science/applications data), and Government Responsibilities (as applicable). SOWs need not be more than a few pages in length. Funding information and documentation must be provided which identifies how funds are to be allocated among the organizations supporting the investigation. Funding documents should be provided which are necessary to allocate the correct amount of funds to each organization supporting the investigation.

4. Certifications: The following certifications must be provided with the proposal.

    a) A copy of the proposing institution's annual Civil Rights Certification form
    b) Certification Regarding Drug-Free Workplace Requirements
    c) Certification Regarding Debarment, Suspension, and Other Responsibility Maters Primary Covered Transactions

    Certifications b and c originals above must be provided with the original proposal. Copies of all certification must be provided in all proposal copies.

The following information may be provided.

1. References List: Proposals may provide, as an appendix, a list of reference documents and materials used in the proposal. The documents and materials themselves cannot be submitted, except as a part of the proposal, unless the reverence is in publication and therefore not generally available.

2. Acronyms List: Proposals may provide, as an appendix, a list of acronyms used in the proposal.

The following will be required in the Concept Study Report, and may be submitted in draft form.

1. Preliminary Mission Definition and Requirements Agreement. A draft Mission Definition and Requirements Agreement should be provided. An example of a Mission Definition and Requirements Agreement is provided in the UnESS Program Library.

2. Draft Incentive Plan. A draft Incentive Plan should be included with the Concept Study Report. This Incentive Plan should outline contractual incentive features for all major team members. Incentive Plans should include both performance and cost incentives, as appropriate.

3. Relevant Experience and Past Performance. Relevant experience and past performance (successes and failures) of the major team partners in meeting cost and schedule constraints in similar projects within the last ten years should be discussed. A description of each project, its relevance to the proposed investigation, cost and schedule performance, and points of contact (including addresses and phone numbers), should be provided.

4. Draft International Agreement(s). Draft International Agreement(s) are required for all non-domestic partners in the investigation. Elements to be included in the International Agreement can be found in the UnESS Project Library.

NO OTHER APPENDICES ARE PERMITTED.

University Earth System Science (UnESS) AO Form I
Investigation Summary Form

AO 99-OES-02 UnESS Announcement of Opportunity	Proposal No. _____ *NASA Use Only*
Principal Investigator *Title* *First Name* *Middle Name* *Last Name*	
Department	
Company/Institution	
Street Address	City/Town
State	Zip/Postal Country
Telephone	Fax E-Mail Address

Proposal Title
Science/Application Research Themes Supported (1 = primary; 2 = secondary) [ ] Biology and Biogeochemistry of Ecosystems and the Global Carbon Cycle [ ] Global Water and Energy Cycle [ ] Climate Variability and Prediction [ ] Atmospheric Chemistry [ ] Solid Earth Science [ ] Food and Fiber [ ] Natural Resources [ ] Disaster Management [ ] Environmental Quality [ ] Urban and Infrastructure [ ] Human Health and Safety
Scientific Theme, Application Research or Commercial Development topic: _____ *Abstract (Limit 150 words)*

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University Earth System Science (UnESS) AO Form II
Investigation Summary Form (Page 2)

AO 99-OES-02 UnESS Announcement of Opportunity	Proposal No. _____ *NASA Use Only*
Principal Investigator *Title* *First Name* *Middle Name* *Last Name*	
Proposal Title	

Mission Mode [ ] Complete Mission [ ] Partial Mission	Cost NASA ESE Cost $_____ Total Mission Cost $ _____

Anticipated Launch Vehicle:

Co-Investigator(s)

Name	Institution	E-mail

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TABLE C-1
TOTAL MISSION COST FUNDING PROFILE TEMPLATE
FOR UNIVERSITY EARTH SYSTEM SCIENCE MISSION

(FY costs* in Real Year Dollars, Totals in Real Year and 1999 Dollars)

Item	FY1	FY2	FY3	FY4	FY5	...	FYn	Total (Real Yr.)	Total (FY 1999)
Concept Study +									
Ground Data System Dev +									
Instrument A +									
Instrument B +									
Spacecraft +									
MSI&T ** +									
Launch services +									
MO&DA*** +									
Student Involvement +									
Other (specify)**** +									
NASA ESE Cost	$	$	$	$	$	$	$	$	$
Goods and/or Services offered on a no-exchange-of-funds basis to:									
Ground Data System Dev									
Instrument A +									
Instrument B +									
Spacecraft +									
MSI&T** +									
Launch services									
MO&DA									
Student Involvement									
Other +									
Goods and/or Services offered on a no-exchange-of-funds basis (Total)	$	$	$	$	$	$	$	$	$
						Total Mission Cost			$

\+ Items included in $15M cost limit described in Section 3.11. Identify "Other " items that apply to limit.
* Costs should include all costs including any fee
** MSI&T - Mission System Integration and Test and preparation for operations
*** Mission Operations and Data Analysis
**** Identify funding for Education and Public Outreach

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TABLE C-2

NASA NEW START INFLATION INDEX

Fiscal Year	1999	2000	2001	2002	2003	2004	2005
Inflation Rate	0%	3.2%	3.1%	3.1%	3.1%	3.1%	3.1%
Cumulative Inflation Index	1.0	1.032	1.064	1.097	1.131	1.166	1.202

Use an inflation rate of 3.1% for years beyond 2005.

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APPENDIX D

CONTENTS OF THE UNIVERSITY EARTH SYSTEM SCIENCE (UnESS) PROJECT LIBRARY

The UnESS Project Library includes documents available electronically via the Internet, as well as paper copy. Proposers are requested to access the documents electronically where possible. Only limited paper copies of documents are available. Please note that not all documents are available via the UnESS Project Library, but access information is provided.

It is incumbent upon the proposer to ensure that the documents used in proposal preparation are of the date and revision listed in the AO or this Appendix. Also, the library will be updated when new or updated documents are made available; therefore, it is incumbent upon the proposer to check the library often.

The UnESS Project Library is accessible on the World Wide Web at the URL address http://uness.larc.nasa.gov/uness.

Requests for paper copies should be submitted in writing to:

UnESS Project Library
Mail Stop 160
Langley Research Center
National Aeronautics and Space Administration
Hampton, VA 23681-0001
FAX: (757) 864-8894
E-mail: d.e.avery@larc.nasa.gov

NASA AGENCY REFERENCES:

1. NASA Strategic Plan

2. NASA Technology Plan

EARTH SCIENCE REFERENCES:

NASA

3. Earth Science Strategic Enterprise Plan 1998-2002

4. Harriss, R. et al, (1996), NASA Mission to Planet Earth Science Research Plan, NASA Headquarters, Washington, DC 20546

5. Mission to Planet Earth/Earth Observing System Reference Handbook

6. Science Strategy for the Earth Observing System

7. Science Plan for Earth Observing System

8. Report of the Workshop on NASA Earth Science Enterprise Post-2002 Missions

9. Understanding Our Changing Planet: 1998 Fact Book

10. Application Fact Book

11. Land Cover Land Use Change Program

12. MTPE Commercial Strategy

13. EOSDIS Potential User Conference Proceedings

14. In Situ Observations for the Global Observing Systems

15. Earth Science Integrated Technology Strategy (Currently under review)

16. Office of Earth Science Data and Information Policy Guidelines

17. Program Cost Elements (Currently under review)

18. Office of Earth Science Guidelines for Concept Study Report Preparation

EXTERNAL

19. National Academy of Sciences (1995) A Review of the U.S. Global Change Research Program and NASA's Mission to Planet Earth/Earth Observing System

20. Committee on Environment and National Resources (CENR) Research of the National Science and Technology Council (1996) Our Changing Planet: the FY 98 U.S. Global Change Research Program, A Supplement to the President's Fiscal Year 1998 Budget

TECHNICAL:

PROJECT MANAGEMENT

21. NASA Program and Project Management Processes and Requirements (NPG 7120.5A)

COMMUNICATION

22. CCSDS Standards

ENVIRONMENTAL TEST REQUIREMENTS

23. General Environmental Verification Specification for STS & ELV Payloads, Subsystem and Components

EDUCATION:

24. MTPE Education Strategic Plan

25. NASA Implementation Plan for Education 1999 to 2003

LAUNCH SERVICES:

EXPENDABLE LAUNCH VEHICLES (ELVs)

26. NPD 8610 Launch Services Risk Mitigation Policy for NASA, NASA-Sponsored Payloads

27. Delta II Med-Lite Payload Planners Guide (Not Currently Available Electronically)

28. Small Expendable Launch Vehicle Services (SELVS) II (Not Currently Available Electronically)

SHUTTLE

29. ESSP Space Shuttle Launch Opportunities

30. Shuttle Small Payloads Project Office

31. Spartan Project

32. Space Shuttle Future Flights

33. UnESS Shuttle Safety, Reliability, and Quality Assurance Document

INTERNATIONAL SPACE STATION

34. International Space Station UnESS Research Opportunities

FEDERAL ACQUISITION REGULATIONS (FAR) ELECTRONIC DOCUMENTS:

35. Federal Acquisitions Regulations (FAR) GENERAL SERVICES ADMINISTRATION

36. NASA FAR Supplement Regulations

37. NASA Financial Management Manual

GENERAL REFERENCE INFORMATION:

38. EOSDIS Information

39. Standard Form SF1448 Proposal Cover Sheet

40. NASA's Mission Operations and Communication Services (SOMO)

41. Earth Science Systems Program Library (MTPE Library) (Information ONLY, no documents are available from this site)

42. Mission Definition and Requirements Agreement - Example

43. Elements to be Included in Arrangements between U.S. Principal Investigators and Cooperating foreign Parties Under the ESSP Program

44. ESSP Mission Confirmation Plan

45. HBCU/OMU Example Uses for Office of Equal Opportunity Funding

46. Examples of Education and Public Outreach Activities

47. U.S. Accredited Post Secondary Minority Institutions

48. Basics of Space Flight

RELIABILITY AND QUALITY ASSURANCE, MATERIALS AND EEE PARTS:

49. NASA/GSFC Office of Systems Safety and Mission Assurance

50. NASA Technical Standards

- NASA Technical Standard NASA-STD-8739.3, Soldered Electrical Connections
- NASA Technical Standard NASA-STD-8739.4, Crimping, Interconnecting Cables, Harnesses, and Wiring

- NAS 5300.4(3J-1), Workmanship Standard for Staking and Conformal Coating of Printing Wiring Boards and Electronic Assemblies (Not Currently Available Electronically)

- NASA Technical Standard NASA-STD-8739.7, Electrostatic Discharge Control (Excluding Electrically Initiated Explosive Devices)

- NASA Technical Standard NASA-STD-8739.5, Fiber Optic Terminations, Cable Assemblies, and Installation

- NAS 5300.4(3M) Workmanship Standard for Surface Mount Technology (Not Currently Available Electronically)

- ANSI/IPC-D-275 Design Standard for Rigid Printed Boards and Rigid Printed Board Assemblies, Class 3 (Not Currently Available Electronically)

- IPC 6011 and IPC 6012, Class 3 as the basic specification requirements with GSFC S-312-P-003B, Procurement Specification for Rigid Printed Wiring Boards for Space Applications and other High Reliability Uses as a supplement (Not Currently Available Electronically)

SAFETY:

51. NSTS 1700.7B, "Safety Policy and Requirements for Payloads Using the Space Transportation System"

52. SPW S-100/KHB 1700.7B, "Space Shuttle Payload Ground Safety Handbook" (Document does not include Appendices)

53. EWR 127-1, "Eastern and Western Range Safety Requirements"

54. NPD 8710.3 NASA Policy For Limiting Orbital Debris Generation

55. NSS 1740.14 Guidelines and Assessment Procedures for Limiting Orbital Debris

56. RSM-93, "Range Safety Manual for Goddard Space Flight Center (GSFC)/Wallops Flight Facility (WFF)" (Not Currently Available Electronically)

57. (SSD TD-0005) (currently Rev B), "Pegasus Design Safety Requirements Document" (Not Currently Available Electronically)

58. (SSD TD-0018) (currently Rev A), "Pegasus Safety Requirements Document for Ground Operations" (Not Currently Available Electronically)

OTHER NASA SERVICES:

59. NASA Space Operations Mission Office

60. NASA/GSFC Mission Management Office

61. NASA Tracking Resources Catalog

ISO 9000 Series:

62. The following ISO 9000 quality documents describe current national and NASA standards of quality processes and procedures.

- American National Standard, "Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation, and Servicing," ANSI/ASQC Q9001-1994.

- "Quality Management and Quality System Elements - Guidelines," ANSI/ASQC Q9004-1-1994.

- "Quality Management and Quality Assurance Standards - Guidelines for Selection and Use," ANSI/ASQC Q9000-1-1994.

- "ISO 9000 and NASA," Code Q presentation, April 24, 1995.

Note: The first three ISO 9000-related documents are copyrighted and cannot be reproduced without appropriate compensation. For copies contact:

American Society for Quality Control (ASQC)
P.O. Box 3066
Milwaukee, WI 53201-3066
800-248-1946

APPENDIX E

REGULATIONS GOVERNING PROCUREMENT OF FOREIGN GOODS OR SERVICES

The following Federal Acquisition Regulation (FAR) clauses cover the purchase of foreign goods and services and may be included in contracts resulting from this Announcement of Opportunity:

52.225-3 Buy American Act -- Supplies (January 1994)

52.225-7 Balance of Payments Program (April 1984)

52.225-9 Buy American Act -- Trade Agreements -- Balance of Payments Program (January 1994)

52.225-10 Duty-Free Entry (April 1984)

52.225-11 Restrictions on Certain Foreign Purchases (May 1992)

52.225-17 Buy American Act -- Supplies Under European Community Agreement (May 1995)

52.225-18 European Community Sanction for End Products (May 1995)

52.225-19 European Community Sanction for Services (May 1995)

52.225-21 Buy American Act -- North American Free Trade Agreement Implementation Act -- Balance of Payments Program (January 1994)

The proposer is directed to the Federal Acquisition Regulation and the NASA FAR Supplement for further information on these regulations.

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APPENDIX F

CERTIFICATIONS

The following certifications must be provided with the proposal.

a) A copy of the proposing institution's annual Civil Rights Certification form
b) Certification Regarding Drug-Free Workplace Requirements
c) Certification Regarding Debarment, Suspension, and Other Responsibility Maters Primary Covered Transactions

Certifications b and c originals above must be provided with the original proposal. Copies of all certification must be provided in all proposal copies.

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CERTIFICATION REGARDING DRUG-FREE WORKPLACE REQUIREMENTS

This certification is required by the regulations implementing the Drug-Free Workplace Act of 1988, 34 CFR Part 85. Subpart F. The regulations, published in the January 31, 1989 Federal Register, require certification by grantees, prior to award, that they will maintain a drug-free workplace. The certification set out below is a material representation of fact upon which reliance will be placed when the agency determines to award the grant. False certification or violation of the certification shall be grounds for suspension of payments, suspension or termination of grants, or government-wide suspension or debarment (see 34 CFR Part 85, Sections 85.615 and 85.620).

I. GRANTEES OTHER THAN INDIVIDUALS

A. The grantee certifies that it will provide a drug-free workplace by:

(a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;

(b) Establishing a drug-free awareness program to inform employees about --

(1) The dangers of drug abuse in the workplace;

(2) The grantees policy of maintaining a drug-free workplace;

(3) Any available drug counseling, rehabilitation, and employee assistance programs; and

(4) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

(c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);

(d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will

(1) Abide by the terms of the statement; and

(2) Notify the employer of any criminal drug statute conviction for a violation occurring in the workplace no later than five days after such conviction;

(e) Notifying the agency within ten days after receiving notice under subparagraph (d) (2) from an employee or otherwise receiving actual notice of such conviction;

(f) Taking one of the following actions, within 30 days of receiving notice under subparagraph (d) (2), with respect to any employee who is so convicted --

(1) Taking appropriate personnel action against such an employee, up to and including termination; or

(2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or Local health, Law enforcement, or other appropriate agency;

(g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (a), (b), (c), (d), (e), and (f)

B. The grantee shall insert in the space provided below the site(s) for the performance or work done in connection with the specific grant:

Place of Performance (Street address, city, county, state, zip code)

_____

_____

_____

_____

Check _____ if there are workplaces on file that are not identified here.

II. GRANTEES WHO ARE INDIVIDUALS

The grantee certifies that, as a condition of the grant, he or she will not engage in the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance in conducting any activity with the grant.

Organization Name | AO or NRA Number and Title

Printed Name and Title of Authorized Representative

Signature | Date

Printed Principal Investigator Name | Proposal Title

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CERTIFICATION REGARDING
DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS
PRIMARY COVERED TRANSACTIONS

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 14 CFR Part 1265.

A. The applicant certifies that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three-year period preceding this application been convicted or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph A.(b) of this certification;

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or Local) terminated for cause or default; and

B. Where the applicant is unable to certify to any of the statements in this certification, he or she shall attach an explanation to this application.

C. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lowered Tier Covered Transactions (Subgrants or Subcontracts)

(a) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principles is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department of agency.

(b) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name	AO or NRA Number and Title
Printed Name and Title of Authorized Representative	
Signature	Date
Printed Principal Investigator Name	Proposal Title

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APPENDIX G

DEFINITIONS AND ACRONYMS

G.1 CONTINGENCY, RESERVE, AND MARGINS

Contingency (or *reserve*) when added to a resource results in the maximum expected value for that resource. Percent contingency is the value of the contingency divided by the value of the resource less the contingency.

Margin is the difference between the maximum possible value of a resource (the physical limit or the agreed-to limit) and the maximum expected value for a resource. Percent margin for a resource is the available margin divided by its maximum expected value.

Example: A payload in the design phase has an estimated mass of 115 kg including a mass reserve of 15 kg. There is no other payload on the ELV and the ELV provider plans to allot to you the full capability of the vehicle, if needed. The ELV capability is 200 kg. The mass reserve is 15/100 = 15% and the mass margin is 85 kg or 85/115 = 74%.

Example: The end-of-mission life capability of a spacecraft power system is 200 watts. Your instrument is expected to use 50 watts, including 20% contingency. You are allotted 75 watts by the satellite provider. Your reserve is 10 watts and your margin is 25 watts, or 25/50 = 50%.

G.2 TECHNOLOGY READINESS LEVELS

Technology Readiness Levels (TRLs) are a systematic metric/measurement system that supports assessments of the maturity of a particular technology and the consistent comparison of maturity between different types of technology. The TRL approach has been used on-and-off in NASA space technology planning for many years and was recently incorporated in the NASA Management Instruction (NMI 7100) addressing integrated technology planning at NASA. The following are the nine TRLs:

TRL 1 Basic principles observed and reported

TRL 2 Technology concept and/or application formulated

TRL 3 Analytical and experimental critical function and/or characteristic proof-of-concept

TRL 4 Component and/or breadboard validation in laboratory environment

TRL 5 Component and/or breadboard validation in relevant environment

TRL 6 System/subsystem model or prototype demonstration in a relevant environment (ground or space)

TRL 7 System prototype demonstration in a space environment

TRL 8 Actual system completed and "flight qualified" through test and demonstration (ground or space)

TRL 9 Actual system "flight proven" through successful mission operations

Discussion of Each Level

The following paragraphs provide a descriptive discussion of each technology readiness level, including an example of the type of activities that would characterize each TRL.

TRL 1 *Basic principles observed and reported*

This is the lowest "level" of technology maturation. At this level, scientific research begins to be translated into applied research and development. Examples might include studies of basic properties of materials (e.g., tensile strength as a function of temperature for a new fiber).

TRL 2 *Technology concept and/or application formulated*

Once basic physical principles are observed, then at the next level of maturation, practical applications of those characteristics can be 'invented' or identified. For example, following the observation of high critical temperature (HTc) superconductivity, potential applications of the new material for thin film devices (e.g., SIS mixers) and in instrument systems (e.g., telescope sensors) can be defined. At this level, the application is still speculative: there is not experimental proof or detailed analysis to support the conjecture.

TRL 3 *Analytical and experimental critical function and/or characteristic proof-of-concept*

At this step in the maturation process, active research and development (R&D) is initiated. This must include both analytical studies to set the technology into an appropriate context and laboratory-based studies to physically validate that the analytical predictions are correct. These studies and experiments should constitute "proof-of-concept" validation of the applications/concepts formulated at TRL 2. For example, a concept for High Energy Density Matter (HEDM) propulsion might depend on slush or super-cooled hydrogen as a propellant: TRL 3 might be attained

when the concept-enabling phase/temperature/pressure for the fluid was achieved in a laboratory.

TRL 4 *Component and/or breadboard validation in laboratory environment*

Following successful "proof-of-concept" work, basic technological elements must be integrated to establish that the "pieces" will work together to achieve concept-enabling levels of performance for a component and/or breadboard. This validation must devised to support the concept that was formulated earlier, and should also be consistent with the requirements of potential system applications. The validation is relatively "low-fidelity" compared to the eventual system: it could be composed of ad hoc discrete components in a laboratory. For example, a TRL 4 demonstration of a new 'fuzzy logic' approach to avionics might consist of testing the algorithms in a partially computer-based, partially bench-top component (e.g., fiber optic gyros) demonstration in a controls lab using simulated vehicle inputs.

TRL 5 *Component and/or breadboard validation in relevant environment*

At this, the fidelity of the component and/or breadboard being tested has to increase significantly. The basic technological elements must be integrated with reasonably realistic supporting elements so that the total applications (component-level, sub-system level, or system-level) can be tested in a 'simulated' or somewhat realistic environment. From one-to-several new technologies might be involved in the demonstration. For example, a new type of solar photovoltaic material promising higher efficiencies would at this level be used in an actual fabricated solar array 'blanket' that would be integrated with power supplies, supporting structure, etc., and tested in a thermal vacuum chamber with solar simulation capability.

TRL 6 *System/subsystem model or prototype demonstration in a relevant environment (ground or space)*

A major step in the level of fidelity of the technology demonstration follows the completion of TRL 5. At TRL 6, a representative model or prototype system or system — which would go well beyond ad hoc, 'patch-cord' or discrete component level breadboarding — would be tested in a relevant environment. At this level, if the only 'relevant environment' is the environment of space, then the model/prototype must be demonstrated in space. Of course, the demonstration should be successful to represent a true TRL 6. Not all technologies will undergo a TRL 6 demonstration: at this point the maturation step is driven more by assuring management confidence than by R&D requirements. The demonstration might represent an actual system application, or it might only be similar to the planned application, but using the same technologies. At this level, several-to-many new technologies might be integrated into the demonstration. For example, a innovative approach to high temperature/low mass radiators, involving liquid droplets and composite materials, would be demonstrated to TRL 6 by actually flying a working, sub-scale (but scaleable) model of the system on a Space Shuttle or International Space Station 'pallet.' In this example, the reason space is the 'relevant' environment is that microgravity plus

vacuum plus thermal environment effects will dictate the success/failure of the system — and the only way to validate the technology is in space.

TRL 7 *System prototype demonstration in a space environment*

TRL 7 is a significant step beyond TRL 6, requiring an actual system prototype demonstration in a space environment. It has not always been implemented in the past. In this case, the prototype should be near or at the scale of the planned operational system and the demonstration must take place in space. The driving purposes for achieving this level of maturity are to assure system engineering and development management confidence (more than for purposes of technology R&D). Therefore, the demonstration must be of a prototype of that application. Not all technologies in all systems will go to this level. TRL 7 would normally only be performed in cases where the technology and/or subsystem application is mission critical and relatively high risk. Example: the Mars Pathfinder Rover is a TRL 7 technology demonstration for future Mars micro-rovers based on that system design. Example: X-vehicles are TRL 7, as are the demonstration projects planned in the New Millennium spacecraft program.

TRL 8 *Actual system completed and "flight qualified" through test and demonstration (ground or space)*

By definition, all technologies being applied in actual systems go through TRL 8. In almost all cases, this level is the end of true 'system development' for most technology elements. Example: this would include DDT&E through Theoretical First Unit (TFU) for a new reusable launch vehicle. This might include integration of new technology into an existing system. Example: loading and testing successfully a new control algorithm into the onboard computer on Hubble Space Telescope while in orbit.

TRL 9 *Actual system "flight proven" through successful mission operations*

By definition, all technologies being applied in actual systems go through TRL 9. In almost all cases, the end of last 'bug fixing' aspects of true 'system development.' For example, small fixes/changes to address problems found following launch (through '30 days' or some related date). This might include integration of new technology into an existing system (such operating a new artificial intelligence tool into operational mission control at JSC). This TRL does not include planned product improvement of ongoing or reusable systems. For example, a new engine for an existing RLV would not start at TRL 9: such 'technology' upgrades would start over at the appropriate level in the TRL system.

G.3 ACRONYMS

AO	Announcement of Opportunity
BAHC	Biospheric Aspects of the Hydrological Cycle
Co-I	Co-Investigator
ELV	Expendable Launch Vehicle
ESE	Earth Science Enterprise
EXPRESS	EXpedite the PRocessing of Experiments for the Space Station
FAR	Federal Acquisition Regulation
GDS	Ground Data System
GEWEX	Global Energy and Water Cycle Experiment
GFE	Government Furnished Equipment
GSE	Ground Support Equipment
HBCU	Historically Black Colleges and Universities
IIP	Instrument Incubator Program
ISS	International Space Station
JPL	Jet Propulsion Laboratory
NASA	National Aeronautics and Space Administration
NFS	NASA FAR Supplement (NFS)
NOI	Notice of Intent
OES	Office of Earth Science
OMU	Other Minority University
PI	Principal Investigator
PM	Project Manager
SOW	Statement of Work
TMCO	Technical, Management, Cost and Other Opportunities
TRL	Technology Readiness Level
UnESS	University Earth System Science
WBS	Work Breakdown Structure
WCRP	World Climate Research Program
WORF	Window Observational Research Facility

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